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PROJECT CHECO SOUTHEAST ASIA REPORT

THE F-111 IN SOUTHEAST ASIA SEPTEMBER 1972–JANUARY 1973

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14. ABSTRACT

Project CHECO was established in 1962 to document and analyze air operations in Southeast Asia. Over the years the meaning of the acronym changed several times to reflect the escalation of operations: Current Historical Evaluation of Counterinsurgency Operations, Contemporary Historical Evaluation of Combat Operations and Contemporary Historical Examination of Current Operations. Project CHECO and other U. S. Air Force Historical study programs provided the Air Force with timely and lasting corporate insights into operational, conceptual and doctrinal lessons from the war in SEA.

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Contemporary
Historical
Examination of
Current
Operations
REPORT

THE F-111 IN SOUTHEAST ASIA SEPTEMBER 1972–JANUARY 1973

21 FEB 1974

HQ PACAF

Directorate of Operations Analysis
CHECO/CORONA HARVEST DIVISION

Prepared by:
HQ PACAF/XOAD

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PROJECT CHECO REPORTS

The counterinsurgency and unconventional warfare environment of Southeast Asia has resulted in USAF airpower being employed to meet a multitude of requirements. These varied applications have involved the full spectrum of USAF aerospace vehicles, support equipment, and manpower. As a result, operational data and experiences have accumulated which should be collected, documented, and analyzed for current and future impact upon USAF policies, concepts, and doctrine.

Fortunately, the value of collecting and documenting our SEA experiences was recognized at an early date. In 1962, Hq USAF directed CINCPACAF to establish an activity which would provide timely and analytical studies of USAF combat operations in SEA and would be primarily responsive to Air Staff requirements and direction.

Project CHECO, an acronym for Contemporary Historical Examination of Current Operations, was established to meet the Air Staff directive. Based on the policy guidance of the Office of Air Force History and managed by Hq PACAF, with elements in Southeast Asia, Project CHECO provides a scholarly "on-going" historical examination, documentation, and reporting on USAF policies, concepts, and doctrine in PACOM. This CHECO report is part of the overall documentation and examination which is being accomplished. It is an authentic source for an assessment of the effectiveness of USAF airpower in PACOM when used in proper context. The reader must view the study in relation to the events and circumstances at the time of its preparation--recognizing that it was prepared on a contemporary basis which restricted perspective and that the author's research was limited to records available within his local headquarters area.

Robert E. Hiller

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Chief, Operations Analysis
DCS/Plans and Operations

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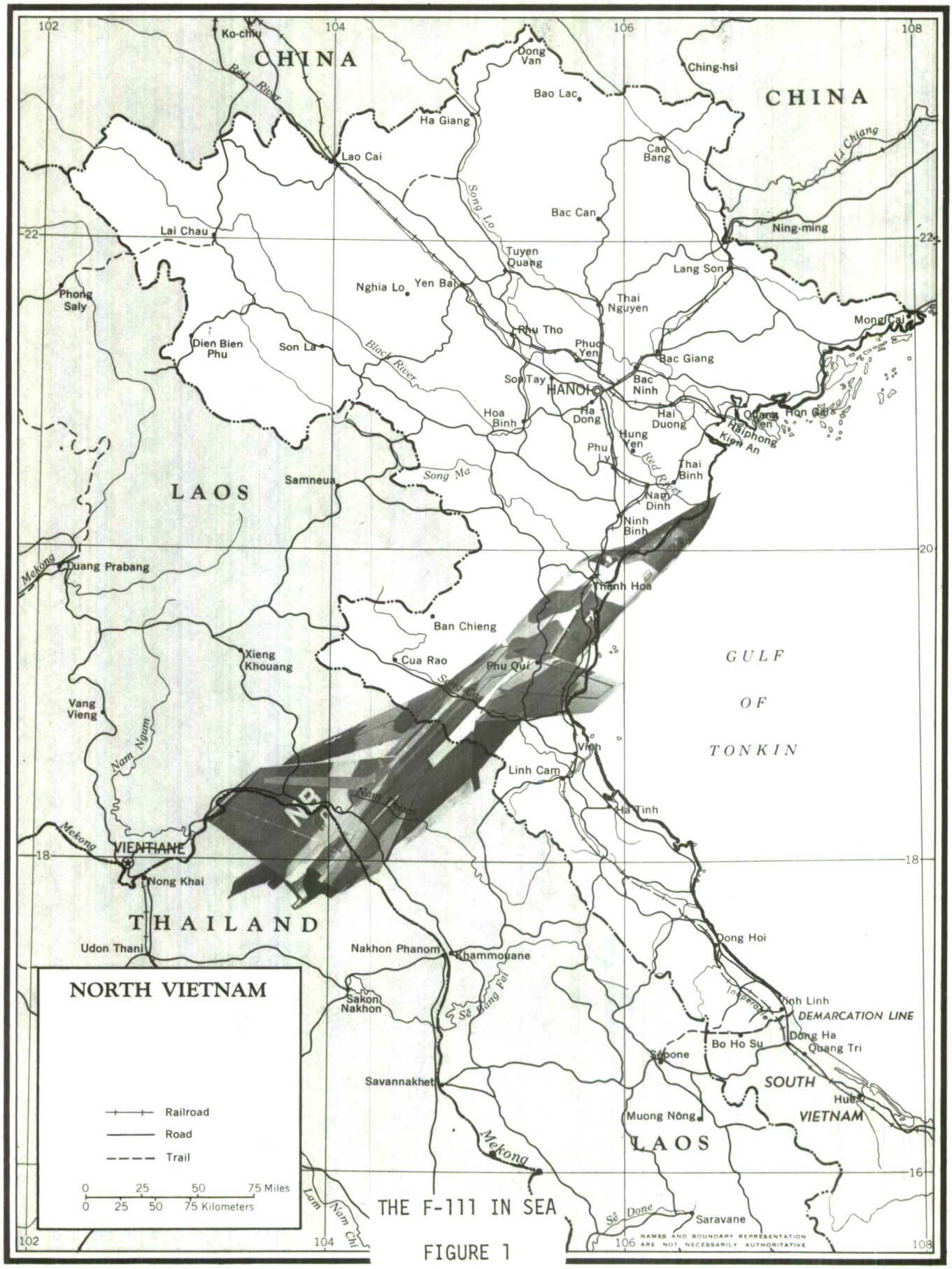
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ABOUT THE AUTHORS

This report was written as a special project by the personnel of the CHECO/CORONA HARVEST Division, DCS/Plans and Operations, Hq PACAF. The primary authors were Colonel A. A. Picinich, Division Chief (who also initiated the report and supervised its preparation), and Captains J. C. Bethea, R. F. Burnham, Jr., T. D. DesBrisay, and K. C. Simonin. Captain D. T. Radzykewycz served as project coordinator and editor.

FOREWORD

(C) The F-111 saw service twice in Southeast Asia. Its first, limited use in combat occurred in 1968, but the aircraft was withdrawn from SEA that same year. Yet, the F-111 possessed capabilities that were considered significant in the military and political situation which evolved following the massive North Vietnamese invasion of South Vietnam in the Spring of 1972. To capitalize upon these capabilities, the aircraft was reintroduced into the theater of operations. This report discusses the reintroduction of the F-111 into SEA, analyzes its operations and effectiveness, and examines its losses.



THE F-111 IN SEA

FIGURE 1

CHAPTER I

PACAF CONCEPT FOR F-111 OPERATIONS

(S) The concept of operations developed in 1972 for the combat employment of the F-111 weapon system in Southeast Asia (SEA) was designed to take full advantage of the capabilities of the F-111 in the night, adverse weather strike role. Historically, the North Vietnamese (NVN*) had used the hours of darkness and periods of inclement weather to move units into positions for an attack, to resupply and regroup, and to reinforce their lines of communication (LOCs) because of the limits in tactical air (TAC AIR) capabilities to continuously engage the enemy. Because of its range, weapon load, navigational precision, and weapons delivery accuracy, the F-111 was planned to complement other SEA strike aircraft in providing an expanded spectrum of tactical air capability.[1]

(S) It was envisioned that the F-111 in SEA operations would assist in reducing the NVN war-supporting capability by conducting sustained deep interdiction combat operations. The aircraft's radius of action and terrain following radar (TFR) provided the capability for a low-altitude approach to either a fixed or time-sensitive target.

(S) As delineated in the PACAF concept, the F-111 would be selectively committed against only high priority radar-significant targets.** Its utilization was postulated as an independent weapon system. It would be used at very low altitudes, 200-1,000 feet above ground level (AGL), depending

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*NVN--used for both North Vietnam and North Vietnamese.

**Although included in the concept, the actual early deployment deviated from this plan. See p. 13 ff, below.

on terrain and defenses, on single aircraft penetrations into high threat areas of NVN. Flight profiles were structured to maximize the element of surprise and to ensure the highest possible degree of aircraft and crew survivability. Accordingly, the following factors were to be incorporated in operational planning data:[2]

(1) random routes and time-on-targets (TOTs) (night only);

(2) final attack headings for repetitive strikes on the same target would be varied to avoid the emergence of discernible patterns;

(3) no requirement for support aircraft (unless dictated by mission requirements).

PACAF believed that the pre-positioning of jamming aircraft or pre-TOT overflights of the target area would only degrade the element of surprise desired under the concept. Furthermore, when configured with an optimum weapons load, the F-111 was capable of striking all the target areas in NVN unrefueled, thereby eliminating the need for tanker support.*

(S) Normal delivery tactics for the F-111 were to be predicated on the low-altitude surprise-attack role, with the type weapon being delivered determining the selection of the particular weapons release maneuver.[3] For instance, when configured with high-drag munitions, a low-altitude level delivery would be accomplished utilizing TFR at 200-500 feet AGL. Approach speeds were to be the maximum obtainable at full

---

*(S) Although it was possible to hit all targets in NVN unrefueled, some compromises were required on sorties against targets on the northeast railroad. In many cases, crews remained at medium altitude well past the NVN border, passed closer than desired to SAM defended areas and climbed back to medium altitude while still over NVN in an effort to ensure an adequate amount of fuel for recovery at Takhli RTAFB.

military power except when limited by munitions carriage and release restrictions. (The "military power" setting would be used to avoid the highly visible afterburner plume which resulted when maximum power was used.) Egress from the target area was also to be at full military power and at the selected TFR altitude.

(S) When configured with low-drag weapons, a change in tactics was planned in that a stabilized climb would be used in the weapons release maneuver. This mode of munition delivery was required to ensure safe separation time and clearance from the bomb fragmentation envelope. As in high-drag munition tactics, the approach to the target was to be flown on TFR at 200-500 feet AGL. However, at 15-20 seconds prior to the computed weapons release time the aircraft was maneuvered to a 10-degree stabilized climb with bomb release initiated by the Ballistic Computer Unit. After the aircraft was established on the desired egress track, military power was to be used and the TFR was to be engaged.

(S) The primary weapons load for F-111 operations in SEA was conceived as: (1) 12 MK-82 bombs with either retarded (preferred) or conical fins, or (2) four MK-84 bombs. (The F-111A was certified to carry both the MK-82 and MK-84 bomb.) The maximum load envisioned for combat operations was 24 MK-82s; however, that load seriously degraded aircraft maneuverability and range characteristics due to an increased drag index and a consequent reduction in obtainable military power airspeed. The airspeed limitation could be overcome by the use of the afterburner, but this in turn would reduce the desired element of surprise and would increase

susceptibility to damage or loss from enemy defenses. Incorporating a requirement for afterburner use on a planned basis would also restrict the range capability of the aircraft. Furthermore, in order to carry the maximum bomb load, a reduced initial fuel load would be necessary to meet takeoff gross weight limitations. These factors also impacted on the obtainable unrefueled radius of action.

(S) The mission profiles planned for F-111 use from Takhli Royal Thai Air Force Base (RTAFB) enabled the F-111 to strike all target areas of North Vietnam without air refueling. The profiles were high-low-high with descent to low level TFR timed to permit the aircraft to remain below threat radar coverage and to minimize the risk of encountering airborne enemy interceptors. The low-level portions of the profiles were routed through mountainous areas whenever possible to take advantage of terrain masking to conceal exact flight routing and actual target areas. Sample profiles generally routed the aircraft through northern Laos with planned descent to TFR altitudes varying from the Thailand/Laos border for close targets to the Laos/NVN border for deep targets. Egress routes were generally planned to prevent extensive traversing of the high threat Red River delta area, and terrain masking was to be exploited both prior to and following weapons release. Exceptions to these procedures were limited to those instances in which coastal targets were to be struck and it was deemed advantageous to either enter or exit over the Gulf of Tonkin (GOT).[4]

CHAPTER II

DEPLOYMENT

A. (S)(U) Deployment Preparation

(S) The introduction of the F-111 added a new capability to the USAF air interdiction campaign, night/all-weather operations. Around-the-clock pressure against North Vietnam was now possible. The F-111 had the ability to penetrate to the NVN heartland without using tankers or any other support aircraft. Highly sophisticated avionics packages, such as terrain following radar and terrain mapping attack radar, made low altitude/high speed ingress to the target area possible and provided automatic bomb release without visual acquisition of the target.

(S) Takhli RTAFB was selected as the beddown base for the F-111. The 474th Tactical Fighter Wing (TFW) from Nellis AFB, Nevada, was designated to deploy two squadrons of 24 F-111 aircraft each to Takhli. Coinciding with the arrival of the 474th, the 49th TFW (with its 72 F-4s), then at Takhli, was to return to Holloman AFB, New Mexico. This deployment/redeployment, nicknamed CONSTANT GUARD V, was carried out simultaneously to minimize disruption of combat operations in SEA. To ensure an orderly switchover at Takhli, preparations were initiated well in advance of the move.[5]

1. (S)(U) Nellis AFB, Nevada

(S) Preparation for the CONSTANT GUARD V deployment began at Nellis AFB approximately 30 days prior to the move. For deployment personnel these preparations included indoctrination briefings conducted by PACAF and 474th TFW intelligence personnel on a myriad of subjects. Aircrews were briefed on Rules of Engagement for all countries in SEA with

particular emphasis on NVN, which would be the F-111s' major area of responsibility. Enemy threat and capabilities were also briefed, viz., the NVN Air Order of Battle (AOB), Surface-to-Air Missile (SAM) threat, and Anti-aircraft Artillery (AAA) threat. Enemy AOB briefings included MIG strength and location, air defense ground radar, and MIG warning procedures. Both the SAM and AAA threat briefings covered location, size, and number of weapons.[6]

(S) Since the F-111s were to be used primarily for night, TFR missions, training toward that end was emphasized. Most of the training missions for the two selected squadrons were flown over the mountainous terrain of Nevada. The missions were flown at night using TFR procedures and terminated with weapons delivery practice at the Indian Springs Range 5 bombing complex and the Fallon Naval Air Station EW/bombing range. Emphasis was placed on delivery techniques and escape maneuvers for both high and low drag general purpose bombs delivered from low altitude.*[7]

(S) Training in the use of Radar Homing and Warning (RHAW) devices and Electronic Countermeasures (ECM) equipment was also stressed to ensure that the training environment simulated the actual conditions aircrews would encounter in SEA. RHAW provided the aircrews with visual cockpit

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*(S) However, it should be noted that significant differences existed between the training and deployment environments. While training was conducted in the arid and barren southwestern United States where the FAA severely curtailed mission profiles, the deployment environment was hot and humid, and the vegetation in SEA was very dense in many areas. In addition, less than half the crews had previously dropped anything other than practice bombs.

presentations indicating tracking or lock-on of various enemy fire control radars, as well as indications of an actual SA-2 SAM launch. The system was designed to provide warning to the aircrews so that evasive action could be taken.*[8]

(S) Maintenance preparation of each aircraft to be deployed was intensified and every system was brought to the peak of efficiency. All phase inspections were performed and outstanding Time Compliance Technical Orders (TCTOs) were accomplished prior to the designated aircraft departing Nellis. In addition, equipment which was to be deployed was also checked and discrepancies were repaired prior to shipment.[9]

(U) Since the F-111 night mission required extensive film processing support for preparation of radar prediction target materials and processing of mission radar scope film, it was decided to deploy part of the ES-85 Mobile Film Processing Facility from Nellis to support the 474th TFW in SEA. The ES-85 is a modular, eight-van, air-transportable complex capable of processing black and white and/or color film. Five vans, providing the black and white capability, were deployed to Takhli.[10]

2. (S)(U) Takhli RTAFB, Thailand

(S) Readying Takhli RTAFB for the arrival of the F-111s was complex since such things as maintenance facilities, ramp space, logistics support, personnel billeting, and equipment requirements, to name but a

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*(S) All aircraft were equipped with both the ALQ-94 and the ALQ-87 ECM Pods. In some cases, however, lack of replacement parts degraded the ALQ-94 capability and permitted usage of the aircraft in a low threat environment only.

few, had to be carefully considered. Preparation began in June 1972 with the arrival of a logistics team from PACAF and an F-111 team from Nellis AFB. The teams reviewed all operational, intelligence, and logistics considerations; they identified problem areas and made recommendations for the phase-in of the F-111. Among the problems:

a. (S)(U) Ramp Space and Revetments

(S) The ramp space requirement for any jet aircraft is a function of the physical size of the aircraft as well as its exhaust velocity and jet blast temperatures. The characteristics of the F-111's jet blast dictated that no more than two rows of aircraft could be parked at Takhli if they were unrevetted. As a result of its dimensions, the F-111 required more side-by-side parking space and larger revetments than required by the F-4. Several alternatives were proposed which suggested that space could be saved if the F-111s were parked with wings swept. Since most major maintenance on the F-111 in addition to pre- and post-flight inspections must be performed with wings extended, however, these proposals were considered unworkable.[11]

(S) Seventy-seven revetments for F-4 aircraft were in place at Takhli when the USAF vacated that base in 1971. The Royal Thai Air Force had dismantled 33 of these revetments on the north end of the parking ramp prior to the USAF reoccupation of that base in May 1972. With the influx of F-4s from DaNang and the continental U.S. (CONUS), approximately 75 F-4s were parked unrevetted. The risk to the exposed F-4s was considered acceptable in view of the cost of constructing additional revetments;

however, the risk of exposing the more costly F-111s became unacceptable. PACAF therefore allocated resources for the construction of 46 F-111 revetments and the enlargement of existing F-4 revetments.[12]

b. (S)(U) Power Supply

(S) Observations by the teams visiting Takhli disclosed that facilities for F-111 materiel and maintenance were adequate for co-utilization with the F-4, but with some exceptions. One of these exceptions was in the area of 60 cycle AC power. All facilities were operational on an austere basis since only limited 60 HZ* power was available. Additional generation equipment for 60 HZ power was programmed but not fully installed.** (Since the commercial AC power which was available to the base was 50 HZ rather than 60 HZ, it was not useable for F-111 avionics test purposes.) Adequate 400 cycle AC power was available from MD-4 generators which were deployed from Nellis.[13]

c. (S)(U) Avionics Facility Cooling

(S) The existing avionics facility for F-4 operations was considered adequate with the exception of the air conditioning. Although a cursory survey of the facility revealed three 60-ton units permanently installed, they had been partially cannibalized and were not in operation. Rehabilitation of these units (at an estimated cost of $18,000) would provide adequate cooling for both F-4 and F-111 avionics equipment. As an interim fix, portable window units were used for cooling the building below the maximum temperature permitted for operation of F-111 avionics aerospace ground equipment (AGE).[14]

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*HZ--formerly referred to as "cycles."
**Documentation about the resolution of this problem was not available as this report was being completed. [Ed.]

d. (S)(U) Arresting Gear

(S) Since the F-111 was substantially heavier than the F-4, its requirement for runway arresting gear was different. The F-4 utilized the standard-runout BAK-12 arresting system, while the only system able to safely decelerate the F-111 was the long-runout BAK-12. On 5 August 1972, well in advance of the deployment, 13AF requested that Tactical Air Command (TAC) supply the necessary equipment to modify the existing BAK-12 systems. Action on this request was postponed, and the necessary equipment did not arrive at Takhli until 2 October 1972. Upon its arrival, it was found that much of the equipment was inoperative and had to be repaired or replaced. Due to these problems, installation and checkout of the barrier systems actually required 25 hours instead of the more typical 12 to 14 hours.[15]

e. (S)(U) Miscellaneous Maintenance and Materiel Problems

(S) There were several other maintenance and materiel problems at Takhli which were minor in nature and easily correctable. Field fabrication shops, i.e., sheet metal and welding shops, were equipped for short-term operation only; to enable them to provide full shop operation for F-111 maintenance required the installation of more standardized shop equipment. Dock space for phase inspections and heavy maintenance was critical at Takhli and could accommodate only 10 F-4 or six F-111 aircraft. Yet another problem was the absence of a Precision Measuring Equipment Laboratory (PMEL) on base. Calibration support for Precision Measuring Equipment (PME) was provided by Transportable Field Calibration Units

(TFCUs). However, only some 40 percent of PME requirements were supportable within TFCU capability, and the remainder had to be sent to backup PMELs at Korat and other Thailand bases.[16]

f. (S)(U) Housing

(S) Billeting for both officers and airmen at Takhli was inadequate for the number of personnel there. A scant two weeks prior to CONSTANT GUARD V execution, the 366th TFW reported that housing for all personnel was completely inadequate and that approved projects would only partially alleviate the problem. In order to provide some shelter for personnel at Takhli, an extensive tent city was constructed to house up to 1,800 personnel. Support personnel were identified for movement into the tents while those personnel essential for flight operation at night were given priority for more permanent living facilities. The shortage of adequate living quarters was attributed to Thai personnel occupying barracks which had previously been occupied by USAF enlisted personnel. Priority for air conditioned quarters was naturally given to aircrews, with the night flying crews receiving the highest priority.[17]

3. (S)(U) Target Preparation and Selection

(U) Target preparation was an essential part of all F-111 prestrike planning activities. When new targets were selected, several steps were normally taken to ensure that aircrews had complete knowledge of the target. The first step in this process was a "letter of intent" which was published weekly and outlined targets for each day. Each target was processed to obtain pertinent target data. The data were then analyzed

to determine target compatibility with F-111 capabilities. Once compatibility was established, sufficient target materials (recce photos, charts, etc.) were gathered to support the strike, and radar aim point and axis of attack were selected. A mission profile was then prepared to include ingress and egress routes, altitudes, and update points. The completion of all phases of target analysis normally took from 14 to 24 hours. Targets which had previously been struck required shorter preparation times since materials on these targets were already assembled.[18]

(S) The F-111 was capable of striking any target then on the validated target list. Since planners desired to take advantage of the unique navigational and bombing characteristics of the F-111, PACAF/DOXQ recommended that the targets:[19] (1) be point targets or point elements within an area target; (2) be radar significant targets or be within range of a radar significant offset aiming point (OAP); (3) have target/OAP coordinates which had been precisely mensurated via SENTINEL LOCK/DATE.*

(S) Adhering as much as possible to these characteristics, a joint TAC/PACAF team selected 144 targets. Most were lucrative, point targets located within the high threat area of Route Package (RP) VI A (which included Hanoi). Sixty-four bridges were included. Preparation was begun on target folders and mensuration of target coordinates. A number of targets

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*(S) SENTINEL DATE is a non-deployable data base located at DMAAC (St. Louis); it is used for positioning targets and the determination of the geodetic control (i.e., correctly superimposing photography over the map grid) to produce the SENTINEL LOCK data base. The SENTINEL LOCK data base was developed for field use. It provides a method for precisely determining latitude, longitude, and elevation of navigational fix-points, offset aim points, and targets. Two sets of this data base are presently in SEA; one at Takhli, the other at NKP. SENTINEL LOCK/DATE are photo-positioning data bases. [Ed.]

on this list were identified to the 474th TFW prior to their departure from Nellis.[20]

(S) As a direct result of conversations between PACAF and TAC, it was felt that all initial strikes would be flown against targets derived from the "letter of intent" listing of 32 primary targets. This, however, proved not to be the case; only approximately 10 percent of the pre-planned targets were struck during the first month of operation. The first targets were carefully screened to avoid high threat areas and still provide an estimate of the weapon system's combat capability. Seventh Air Force intended for the F-111 crews to shift gradually from targets in relatively low threat areas to those located in higher threat areas as crew confidence and experience increased. To meet the target requirements, 7AF nominated 56 additional targets, which were subsequently approved by TAC/PACAF, in the lower threat areas of the northern route packages. The target folders were passed to the 474th TFW at Nellis. All mission profiles were high-low-high with the descent point being determined by enemy defenses. The low-level route was to be flown at 1,000 feet utilizing TFR procedures, while the attack run-in was to be flown at 500 feet.[21]

(U) Since the preplanning stage for F-111 strikes required time to piece together mission folders, target planners were concerned over frag lead time; that is, how much time was available from frag reception to mission launch. To ensure that target coordinates and other necessary materials were available in time for target planning and aircrew study, frag lead times would have to be at least 24 hours when materials and

coordinates were to be obtained from sources outside SEA. Thorough coordination between the 474th TFW, PACAF, and 7AF alleviated this concern.[22]

(S) Included in mission preparation was "weaponeering."* In order to obtain the maximum benefit from any strike, using any weapon system, the proper weapons must be utilized. This was especially true when attacking point targets, e.g., bridges, dams, and buildings. Targets to be struck by the F-111 were analyzed to determine the most significant and vulnerable element of the target. This analysis led to the best weapon/fuzing combination to provide the desired weapons effect (bearing in mind tactics and delivery parameters and limitations). Predeployment weaponeering was accomplished by Headquarters PACAF. However, after the arrival of the F-111s in SEA, the pre-strike weaponeering responsibility was transferred to 7AF. A Hq PACAF weaponeer was detailed to augment the 7AF Targets Frag Shop beginning in early October 1972. Headquarters PACAF continued to provide supplemental weaponeering support when requested by 7AF.[23]

(S) Problem areas anticipated by the 474th TFW in locating and securing target materials for mission preparation were resolved prior to the deployment. Arrangements were made by Hq PACAF and the Defense Mapping Agency Aerospace Center (DMAAC) Flight Information Office-Pacific to have all required maps and charts of target areas in NVN in place at Takhli

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*Weaponeering--the process whereby targets are examined for their peculiarities and the proper weapon and fuzing combination is selected to inflict maximum damage on the target. For example, the weapon to be used on the target is selected and then the fuzing (instantaneous, delayed) is selected for that weapon.

when the unit deployed. Initial stereo photo coverage of the Hanoi-Haiphong area was completed by the 548th Reconnaissance Tactical Group (RTG) for use in early target planning. Additional coverage was provided by the 12th Reconnaissance Intelligence Technical Squadron (RITS).[24]

(S) Automated Tactical Target Graphics (ATTG) and other miscellaneous materials for NVN targets were provided by PACAF, while 12th RITS furnished a complete set of Master Target Folders to the unit.[25] SENTINEL DATE coordinates for LINEBACKER* targets were obtained from DMAAC by PACAF and provided to the 474th TFW. SENTINEL LOCK coordinates, needed for mensuration of OAPs, were obtained from a DMAAC SENTINEL LOCK support package deployed to Takhli. A problem in the use of the mensurated coordinates resulted when the mensurated aim point was included in the frag but not annotated on the 474th TFW target photography. Crew members had difficulty in plotting the aim point on the photography while preparing for the mission. A partial solution was obtained when an aim point description was added to the frag information.

B. (S)(U) Deployment

(S) The deployment schedule for the 474th TFW and the redeployment schedule for the 49th TFW were outlined in PACAF Programmed Action Directive (PAD) 73-4. This PAD provided for a closely integrated deployment/redeployment which would not hinder operations at Takhli and would also avoid overcrowding.[26] This schedule is reflected in Figure 2.

*LINEBACKER, which started on 10 May 1972, was a coordinated air and naval campaign aimed at the destruction of the enemy's war materiel and the disruption of his logistics system throughout NVN.

FIGURE 2

SCHEDULED DEPLOYMENT/REDEPLOYMENT SUMMARY - 49TH AND 474TH TFWs

Unit Move	27 Sep D-Day	28 Sep D+1	29 Sep D+2	30 Sep D+3	1 Oct D+4	2 Oct D+5	3 Oct D+6	4 Oct D+7	5 Oct D+8
49 TFW									
417 TFS			Takhli-Andersen	Andersen-Hickam		Hickam-Holloman			
8 TFS				Takhli-Andersen	Andersen-Hickam			Hickam-Holloman	
9 TFS					Takhli-Andersen	Andersen-Hickam	Hickam-Holloman		
434 TFS						Takhli-Andersen	Andersen-Hickam		Hickam-Holloman
474 TFW									
429 TFS	Nellis-Hickam	Hickam-Clark		Clark-Takhli					
430 TFS			Nellis-Hickam		Hickam-Clark	Clark-Takhli			

SOURCE: Tactical Air Augmentation in Thailand, 13AF Study, December 72.

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(S) As indicated in Figure 2, the first squadron of F-111s (429th Tactical Fighter Squadron) was due to arrive at Takhli on 30 Sep 72 (D+3), while the second squadron was to arrive on 2 Oct 72 (D+5). This schedule dovetailed nicely with the scheduled redeployment of the 49th TFW. The first squadron of 18 F-4s was to leave Takhli on 29 Sep 72, one day before the arrival of the 429th Tactical Fighter Squadron (TFS). The 8th TFS was scheduled to depart Takhli on 30 Sep 72. This schedule removed 36 F-4s from Takhli prior to the arrival of the first 24 F-111s. A similar schedule existed for the departure of the 9th and 434th TFSs (F-4) and the arrival of the 430th TFS (F-111).[27]

(U) In actuality, however, the first contingent of 12 F-111s arrived at Takhli on 28 Sep 72, creating an overlap of 12 F-111s and 18 F-4s for a period of 36 hours. This occurred as a result of a last minute change to the F-111 deployment schedule. The first 12 aircraft proceeded directly to Andersen, and, with prepositioned crews, on to Takhli (rather than going via Hickam and Clark as originally scheduled). The 474th Advanced Echelon (ADVON) and parts of the support group also arrived earlier than planned, further adding to the overcrowding at Takhli and causing a corresponding overlap of the inbound and outbound airlift of the two wings. The second half of the 429th TFS (12 F-111s) arrived as scheduled.[28]

(S) All personnel of the 474th ADVON did not arrive as one unit. Some elements were mixed with turnaround crews, which were to fly the first combat sorties, while other elements of the ADVON arrived at a later date. This splitting of the ADVON did have one detrimental effect on the launch

of the first combat sorties: the split ADVON resulted in a reduced number of radar predictors available to aid in pre-planning strikes on completely unfamiliar targets. Although this did increase the workload on the available personnel, ample time existed and was utilized to complete the required target study. Personnel from the 366th TFW, also stationed at Takhli, drew upon their experience and discussed with the F-111 crews matters of operational concern, such as enemy Order of Battle disposition. In addition, the 366th made available to the F-111 crews facilities for target studies and briefs. Earlier, extensive preparatory actions were accomplished by the Wing prior to their deployment. These actions included briefing by both PACAF and Wing intelligence personnel on rules of engagement, the enemy threat, and enemy capabilities. When the advanced crews arrived at Takhli, target materials were in place for the first six targets and route folders and predictions were prepared. Target study was accomplished plus approximately eight hours of briefings on rules of engagement, air order of battle, intelligence, search and rescue, and procedures for command and control.[29]

(U) Deployment/redeployment of later elements in CONSTANT GUARD V also differed from the schedule due to a tropical storm which appeared approximately 600 miles east-northeast of Guam on 1 Oct 72, directly on the flight path between Hickam and Andersen. This storm caused a delay in the departure of the 8th TFW from Andersen, which in turn resulted in ramp parking congestion at that base, forcing postponement of the 9th TFS departure from Takhli which was scheduled for the same day. Adding to the "domino effect," the

430th TFS was at Clark AB waiting for the above movements to take place to free ramp space at Takhli, which could at that time accept no more incoming aircraft without an equivalent outflow. Actual deployment/redeployment times are shown in Figure 3.[30]

(S) Difficulties were also encountered in air-to-air refueling operations during CONSTANT GUARD V. Although these difficulties were not insurmountable, they were matters of concern.[31] The refueling problems included:

1. An unusual number of altitudes required for rendezvous between refueler and receivers.

2. The clearance request for tanker operations was submitted much too late in the mission to allow sufficient time for altitude reservations planning.

3. Tanker coordinators were not properly briefed prior to their arrival at Clark; they did not appear to have a clear idea of their requirements and were unsure of what air traffic control services they would require.

4. There was no single point of contact for coordination for the tanker task force; it was often impossible to locate anyone with decision-making authority.

5. All cells of the first contingent of twelve F-111 aircraft arrived over Jamalig (Philippines) for refueling within five minutes of each other; accomplishing separation for sequencing in the radar and traffic pattern was impossible.

6. The second contingent of F-111 aircraft had been briefed to separate into flights of six fighters and two tankers each under Instrument Flight Rules (IFR) conditions; the first flight complied with the briefing, but the second wave arrived in straggling groups of twos and threes from a variety of directions.

Another fuel-related problem which could have had serious consequences occurred during the recovery of F-111 aircraft at Clark AB. Some aircraft

FIGURE 3

ACTUAL DEPLOYMENT/REDEPLOYMENT SUMMARY - 49TH AND 474TH TFWs

Unit Move	27 Sep D-Day	28 Sep D+1	29 Sep D+2	30 Sep D+3	1 Oct D+4	2 Oct D+5	3 Oct D+6	4 Oct D+7	5 Oct D+8	6 Oct D+9
49 TFW										
417 TFW			Takhli-Andersen	Andersen-Hickam		Hickam-Holloman				
8 TFS				Takhli-Andersen		Andersen-Hickam		Hickam-Holloman		
9 TFS						Takhli-Andersen	Andersen-Hickam		Hickam-Holloman	
434 TFS							Takhli-Andersen	Andersen-Hickam		Hickam-Holloman
474 TFW										
429 TFS	Nellis-Andersen (12 acft)	Andersen-Takhli								
429 TFS	Nellis-Hickam (12 acft)	Hickam-Clark		Clark-Takhli						
430 TFS			Nellis-Hickam	Hickam-Clark				Clark-Takhli		

SOURCE: Tactical Air Augmentation in Thailand, 13AF Study, December 72.

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arrived over the base with low fuel reserves. Fortunately, fair weather permitted expeditious recovery of the fighters.*

(S) Initiation of Military Airlift Command (MAC) airlift for CONSTANT GUARD V coincided with the deployment of the first contingent of F-111 fighters. The first C-141 departed Nellis AFB on 27 Sep 72, and all necessary airlift was completed on 1 Oct 72, shortly after the closure of the 429th TFS. As a consequence, deploying support equipment was in place at Takhli well ahead of the arrival of the second F-111 squadron. Twenty-nine C-141 and six commercial passenger aircraft were employed in CONSTANT GUARD V. These aircraft transported a total of 494.7 tons of cargo and equipment and 1,487 passengers to Takhli. In addition, five C-130 aircraft[32] were used to carry enroute support team equipment and personnel.

(C) All equipment of the 49th TFW which was suitable for F-111 operations and requirements was left in place at Takhli. This procedure prevented shipment of duplicate AGE and kept transportation costs to a minimum. As a result, some 225 tons and 48,744 cubic feet of equipment, which would have required 11 C-141s for transport,[33] was not moved.

(U) One minor problem concerning CONSTANT GUARD V airlift occurred when the Thai government refused to allow MAC commercial contract flights

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*Following their pre-publication review of this report, Hq 474th TFW/DOW noted that: "Hazards related to the arrival at Clark AFB are somewhat underemphasized. Manila approach control radar was inoperative. The Clark AFB Rapcon was incapable of maintaining an orderly traffic flow. They attempted to vector flights directly into thunderstorms and often refused to communicate, apparently due to traffic saturation. This forced some flights to proceed visually to avoid a minimum fuel situation."

to land at any base other than Don Muang or U-Tapao. Consequently, these flights landed at either U-Tapao or Don Muang, and their loads were transferred to C-141s for the trip to Takhli. However, the C-141s were not equipped to transfer all personal baggage arriving on the contract flights carrying personnel. Thus, men arrived at Takhli ahead of their baggage; when it arrived by later flight, there was confusion in matching men to their belongings.[34]

CHAPTER III

OPERATIONS

A. (S)(U) Initial Operations and First Loss

(S) F-111 operations against North Vietnam began on the evening of 28 September 1972, just hours after the first deploying aircraft landed at Takhli RTAFB. The frag for that evening called for six F-111s to strike six targets in Route Package V.* In accordance with the F-111 employment concept, these initial night sorties were fragged to penetrate NVN as single flights at low altitude** (1,000 feet AGL with TFR engaged) and high speed [480 Knots True Air Speed (KTAS)], utilizing low-altitude (500 feet AGL) radar deliveries to strike the target. The missions were to be flown by aircrews already in place at Takhli, deployed from Nellis on 24 September by C-141, and in place at 2200 local time on 26 September. Prior to the arrival of the aircraft these crews had studied detailed target folders and had been briefed on rules of engagement, intelligence, the air order of battle, search and rescue (SAR), command and control arrangements, and safety aspects of the missions.[35]

(S) Of the six aircraft scheduled to participate in the mission, only five were launched. Of these, one aircraft took off, jettisoned fuel, and returned to base. The first night of combat operations for the F-111 following its redeployment to SEA was marred by the loss of one aircraft. Ranger 23, the second aircraft to depart Takhli RTAFB, was last heard from about 40 minutes after launch. At that time the mission was proceeding normally, although the aircraft was deviating somewhat from its planned course in order to avoid

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*See Appendix 1.

**The descent point was determined by the enemy threat.

thunderstorms along the route through Laos. (Such deviations also occurred for other F-111s that night.) Shortly after midnight,* more than two hours after the last radio contact, Ranger 23 was declared missing. Neither the location nor the cause of the loss was known at this writing.[36]

B. (S)(U) Suspension of Operations

(S) Immediately following the loss of Ranger 23, F-111 combat operations were temporarily suspended and a SAR effort was initiated. During the SAR effort, approximately 3,500 square miles of North Vietnamese and Laotian territory was photographed, and another 4,900 square mile area in northern Laos was searched visually. Additionally, all-source intelligence data were carefully screened in the hope that some bit of information might shed light on the location or cause of the loss. By 10 October, however, every available lead had been exhausted, and the search was terminated.[37]

(S) At the time that the search for the missing aircraft was underway, an intensified orientation program was initiated and a reevaluation of the concept of employment of the F-111 was begun. All aircrews were given ground training briefings reemphasizing those specific areas directly concerned with combat operations in SEA. Area orientation flights were flown to familiarize the aircrews with the terrain that they would be encountering. Missions were flown in Thailand to check out aircraft systems and to give the crews an opportunity to visually orient themselves in their new environment. Subsequent night flights over the same areas were also made to validate the performance of the terrain following radar system.

*Times given hereafter, unless otherwise specified, are local times at Takhli.

Prior to these flights, the aircraft underwent an extensive shakedown of both the avionics and weapons systems.[38]

(S) Concurrent with the intensified training and orientation program which was initiated following the loss of Ranger 23, a reevaluation of the concept of employment of the F-111 was undertaken. While the results of this evaluation largely verified the suitability of the original concept of employment, some changes in tactics did occur. The primary change was that enroute altitudes over the extremely rough terrain encountered in Laos and NVN (prior to entering the threat areas) were modified. The previous practice of employing a setting of 1,000 feet on the TFR was changed to maintaining a minimum enroute altitude (MEA) of 1,000 feet above the highest terrain within five miles of the intended route of flight. (This was imposed on the basis of a thorough analysis of the manner in which the F-111's TFR equipment responded to the SEA environment.) After a mission progressed beyond the rugged, mountainous terrain of Laos and NVN, the aircraft was to descend to a TFR altitude of 1,000 feet with a further descent to 500 feet by the time the gently rolling hills or flatlands were reached.[39]

(S) Another modification to original tactics was implemented whereby the aircrew descended to TFR altitude shortly after take-off from Takhli to check the accuracy of the aircraft's TFR. This check was made over known terrain elevations in the vicinity of Takhli with clear instructions that the mission was to be aborted should full system capability not be available. Other tactics, both enroute to and in the target area, remained unchanged.[40]

C. (S)(U) Resumption of Operations

(S) By 4 October, the revised procedures had been implemented, and sufficient crews and aircraft had completed the orientation program to begin the resumption of combat operations. At first, the number of combat sorites was small compared to training and orientation sorties. Additionally, most of these combat sorties were flown against targets located in the lower threat areas of Route Package I or STEEL TIGER.* Gradually, however, the number of combat sorties into RPs V and VI was increased; by 13 October, the desired 24 sorties were being fragged for nighttime strikes in those areas. This gradual build-up of combat sorties and the transition from low to the higher-threat areas increased both the experience and confidence of the F-111 aircrews.

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D. (S)(U) Loss #2

(S) The second F-111 loss occured on 16 October. Coach 33 received his target assignment three days in advance, and the final frag order one full day in advance. As far as could be determined, pre-mission planning and target study were normal in all respects.

(S) Coach 33 departed Takhli at 2252 for a strike against the Dai Loi Railroad Bridge on the Northwest rail line in RP V. The last radar contact occurred at 2339, while Coach 33 was roughly 50 nautical miles (NM) from the Laos/NVN border. (Coach 33 had been scheduled to begin his descent to TFR altitude approximately five minutes later.) At 0007, Coach 27, another F-111 striking a different target in the same general area of RP V, overheard a conversation between Coach 33 and an unspecified agency. The conversation

*See Appendices 1 and 2.

seemed normal. However, at 0153, 17 October, Coach 33 was declared overdue and missing.[42]

(S) Shortly after Coach 33 was declared missing, an infrared-equipped RF-4 was launched to fly the planned profile in an attempt to detect anything that would pinpoint the crash site. As was the case with the loss of Ranger 23, an extensive SAR effort was conducted in the hope that the missing aircraft could be found, the cause of its loss determined, and surviving crewmembers rescued. Unfortunately, visual and photographic searches failed to uncover either the location or the cause of the loss, and no contact was ever made with any survivors. All-source information, however, did offer more clues than had been the case for Ranger 23. There was evidence that Coach 33 might have gone down in, or near, the target. Also, the NVN did claim the shoot-down of the F-111 in the general target area and published photos of the wreckage of an F-111 and identification cards of the two crewmembers.[43] There was, however, no firm evidence as to the cause of the loss.

E. (S)(U) Reappraisal of Operations

(S) Following the loss of the second F-111, the concept of employment was again completely reappraised. Since Coach 33 was probably lost in or near the target area, analysis of the tactics in the target area received particular attention. The missing aircraft had been configured with low drag weapons (four MK-84s) which required a stabilized climb from low level TFR flight to approximately 1,000 feet AGL prior to weapons release. (Conversely, high drag weapons could be delivered at or below 500 feet AGL.) Although the delivery of low drag weapons had been included in the employment concept,

the higher altitudes at which such bombs were released increased the vulnerability of the aircraft to enemy defenses. As a result of this loss, 7AF prohibited the further use of low drag weapons unless specifically fragged on an individual case basis. This impacted on targeting since hard point targets, requiring strike by MK-84 low-drag ordnance, could no longer be fragged because of the release parameters. The standard MK-82 high drag weapons were not effective against hard point targets such as bridges and storage facilities.

(S) Additionally, a change to improve command and control of the F-111 force was implemented as a result of the second loss. To assist 7AF Tactical Air Control Center (TACC), Airborne Battlefield Command and Control Center (ABCCC), and Ground-Controlled Intercept (GCI) controllers, each crew was required to submit a flight plan which included estimated times of arrival (ETAs) at each turn point along the flight route. During the flight, as was the case previously, each aircraft was under positive radar contact until its descent to MEA or TFR altitude. At that point, and at every turn point thereafter, the crew would broadcast position reports to the ABCCC over high frequency (HF) radio. This procedure, while it did not enhance the safety of a particular mission, did provide a means of positive flight monitoring.[44]

F. (S)(U) Cessation of Strikes in Northern NVN

1. (S)(U) Air Defense Activities Preceding the Bombing Halt

(S) Effective 23 October 1972, the President directed a cessation of the bombing above the 20th Parallel in NVN. In the last days

preceding the 23 October bombing halt, however, F-111 strikes in the heavily defended Route Packages V and VI reflected some interesting trends in the enemy's air defense reaction to the strikes. The enemy threat, as manifested during low-level F-111 strikes against targets in these areas, consisted primarily of anti-aircraft artillery and small arms fire, and surface-to-air missile activity. (Of these threats, planners considered AAA the most serious.) MIGs, another potential threat, were not a significant factor during the period of this report. Although MIGs were occasionally airborne at night in the general vicinity of F-111 targets, there was no indication that the flights were anything other than routine training.[45]

(S) The enemy's AAA reactions normally occurred just after weapons release. For the first two or three weeks of F-111 strikes, enemy gunners were apparently unable to determine the correct F-111 altitude. Aircrews believed that barrage AAA fire was directed towards the sound of the aircraft rather than at or ahead of its actual position since detonations were occurring above and behind the aircraft. As F-111 operations continued, however, the AAA worked down to the actual 500-feet AGL altitude of the aircraft, but detonations were still occurring behind the aircraft. The F-111s countered this development by flying at 300 feet or 200 feet AGL during release. On the last night of Route Packages V and VI operations, one F-111 did have barrage fire detonating at his altitude, ahead of his aircraft, at the one and 11 o'clock positions. In the latter days of Route Packages V and VI strikes, the enemy also fired flares to help

mark the flight paths of the aircraft. Although the accuracy of AAA fire was improving, no F-111 aircraft sustained damage due to AAA by the 23 October standdown. It appeared that in addition to the obvious possibility of shooting down an aircraft, however, the enemy employed AAA barrages in an attempt to drive the F-111s up to an altitude where missile sites could acquire and track them.[46]

(S) Despite the low altitudes flown by F-111s, it became apparent that the SAM batteries represented a threat to the aircraft, and, in fact, were in some instances capable of tracking and firing on aircraft as low as 500 feet AGL. By 22 October, F-111s had been illuminated and tracked (i.e., received Radar Homing and Warning [RHAW] indications) on more than 70 occasions; in eight encounters a total of 16 SAMs had been fired. Although there were no known losses, one aircraft had sustained minor damage while others reported near misses.[47]

(S) F-111 anti-SAM tactics employed a combination of chaff, maneuvering, and ECM pod utilization. For example, in one incident two SAMs were launched in rapid succession at an F-111. The first was negated by two bundles of chaff plus a 30 degree banked turn and a descent from 500 to 300 feet AGL; but as soon as the first missile was negated, a second launch occurred. Pods were activated and the bank angle was increased long enough to turn away from the launch area. After the aircraft rolled back out to level flight, the pods appeared to defeat the missile guidance. In view of the ability of SAMs to acquire and track aircraft even at low altitudes, anti-SAM tactics and ECM procedures were subject to continuing review and refinement.[48]

2. (S)(U) Shift to Route Package I and Laos

(S) In the two-month period following cessation of airstrikes above the 20th Parallel and preceding the initiation of LINEBACKER II in late December 1972, F-111 strikes shifted to Route Package I and Laos.[49]

(S) The F-111 tactics employment in RP I remained essentially the same as had been the case for Route Packages V and VI. The F-111 continued to be employed in a night, low altitude, high speed, single-ship penetration, radar delivery role. Throughout late October and the first half of November at least 20 F-111 sorties per night were routinely fragged against logistics and air defense targets throughout RP I. During November the preponderance of the effort (nearly 70 percent of total F-111 RP I sorties) was directed against truck park/supply/storage area type targets. A sizeable number of sorties struck enemy defenses and troop concentrations, while a smaller number struck roads, fords, and interdiction points.[50]

(S) During the latter half of November there was a shift of F-111 sorties from the interdiction role in Route Package I to support of friendly forces in Northern Laos. Despite the shift, however, a sizeable strike effort did continue in RP I, with an average of 10 F-111 sorties scheduled there per day. During the month of November F-111s flew a total of 402 combat sorties in RP I.[51]

(S) During these RP I strikes in November the third and fourth F-111 losses occurred, both due to unknown causes. Loss number three occurred on 7 November during a mission against the Luat Son Highway

Ferry/Ford Complex on Route 101B, some 6.5 NM southeast of Bat Lake. The aircraft last made radio contact with the ABCCC approximately 45 minutes after takeoff. The second loss occurred on 20 November, on a mission against Co Giang Transshipment Point on Route 101, about 8.5 NM southwest of Quang Khe. Again, no information was uncovered revealing the exact location or cause of the loss. In the case of this loss, however, pieces of wreckage from the aircraft were later discovered washed ashore north of Da Nang, indicating that the crash probably occurred during egress over the Gulf of Tonkin.[52]

(S) In November, a new dimension was added to F-111 operations. The use of the F-111 with a radar beacon for offset bombing from medium altitudes* in support of friendly forces in Laos represented a major departure from the initial concept of employment for the aircraft. The beacon bombing program was conceived as the optimum employment of the F-111 weapons system in the defense of Long Tieng, an area of critical importance to the war in Laos. Radar beacons deployed at key locations on the ground were used as offset aiming points for medium altitude radar bombing by the F-111s. This technique, which could be employed within a 30-mile radius** of a given beacon, enabled the F-111 to strike time-sensitive targets developed by Raven Forward Air Controllers (FACs), Laotian Forward Air Guides (FAGs), or ground commanders. Of particular importance was the fact that these strikes were carried out regardless of weather conditions.[53]

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*(U) Above 13,000 feet AGL.

**(S) It should be noted that while the beacon's effective range was approximately 30 miles, the F-111 system had a 16 NM (99,999 feet) ranging limitation with offset beacons.

(S) Two distinct types of targets were struck during the F-111 beacon bombing program--preplanned targets and targets of opportunity. In the case of preplanned targets, the beacon position and target coordinates were known and fragged in advance. Flexibility was provided by the practice of diverting aircraft from preplanned targets to time-sensitive targets, when such diversions were requested by a FAG. In the case of targets of opportunity, the offset distance, bearing, and target elevation from a particular beacon were provided by the ground controller (FAG). For both types of targets the axis of attack was normally planned to vary from 10 to 40 degrees from the offset bearing. Also in both cases, until accurate Circular Error Probable (CEP) data could be determined for the F-111 beacon bombing technique, only targets more than three kilometers from friendly positions were struck.[54]

(S) The first successful F-111 beacon bombing mission in support of friendly Laotian forces was flown on 11 November 1972. By 30 November, 221 such missions had successfully delivered ordnance against targets in northern Laos. During the month of November, F-111s flew 455 combat sorties in Laos, all but 84 of these in the northern part of that country. As confidence in, and experience with, the radar beacon bombing program grew, the number of F-111 sorties in Laos steadily increased, with more than 500 sorties flown there during December.[55]

G. (S)(U) LINEBACKER II

(S) Beginning on 18 December 1972 and continuing through 29 December, a maximum tactical air (TAC AIR) and B-52 air strike effort was directed against selected targets in Route Packages VI A and VI B, with the greatest

emphasis placed on targets in the vicinity of Hanoi and Haiphong. This concentrated bombing program, known as LINEBACKER II, included by far the heaviest B-52 strikes ever directed against targets in NVN, and a TAC AIR effort which easily surpassed the level of strikes directed against the northern RPs in the earlier LINEBACKER I program. F-111s represented a significant element of the strike effort, providing the USAF with the capability to strike targets 24 hours a day in all weather conditions and with minimal support requirements.[56] During LINEBACKER II operations, 154 F-111 strike sorties were directed against a wide variety of enemy targets including airfields, SAM sites, rail targets, storage areas, and communications facilities.

(S) During the initial days of LINEBACKER II, some 50 percent of F-111 sorties (i.e., about seven per day) were directed against enemy airfields. In many cases the strikes were scheduled to precede B-52 arrivals over NVN and were designed to reduce the MIG threat to the subsequent B-52 strikes. While the number of sorties involved was modest, the strikes were a definite harassment to the enemy. In fact, considering the small number of sorties employed, the F-111 showed promise against the radar-significant, large-area targets provided by airfields. Perhaps the best example of F-111 potential was provided when a single F-111 sortie succeeded in temporarily placing Yen Bai airfield in a non-operational status after 44 A-7/F-4s striking under LORAN* conditions had been unable to inflict any serious damage. This was the only period

*LORAN--long range aerial navigation.

in LINEBACKER II during which Yen Bai was considered to be in a non-operational status.[57]

(S) During the last days of LINEBACKER II, a small number of F-111 sorties were targeted against SAM sites which would be a threat to ensuing attacks by high altitude B-52s. While some secondary explosions were reported, the impact of these and other strikes against SAM sites was not fully known due to the small number of strikes involved and the lack of complete and accurate information. A sudden reduction in SAM launches prompted the Strategic Air Command to specifically request F-111 prestrikes. However, a PACAF analysis did indicate that scheduling F-111 strikes against airfields and SAM defenses in advance of B-52 strikes should be done with caution, since stereotyping of F-111 operations could result in a subsequent increase in the threat to these operations.[58]

(S) Storage areas and rail facilities were two other types of targets struck by F-111s during LINEBACKER II. With a limited number of sorties, F-111s achieved significant damage against large-area storage targets and were successful in keeping pressure on the enemy in areas where significant damage had already been inflicted by other weapons systems. With regard to rail yards, the F-111 strike effort was light. Nevertheless, Bomb Damage Assessment (BDA) revealed that damage was inflicted on all of the F-111 targets, establishing a definite military impact in addition to the obvious psychological/harassment effect.[59]

(S) In some cases, F-111 sorties were also used to strike pinpoint targets such as radio communications facilities and bridges. Such strikes

were generally in the target area, but, due to the nature of the targets and unsuitable high drag ordnance, only limited damage was attained. For example, radio communications facilities had a single essential element, the transmitter/receiver control building, generally protected by a concrete blast wall requiring a direct hit to ensure destruction. Guided ordnance, when weather conditions permitted its employment, offered by far the most efficient means of destroying such targets.[60]

(S) During LINEBACKER II operations, enemy reactions against F-111s consisted primarily of moderate AAA firings, with very few pilots reporting accurate fire. Four aircraft were known to have sustained minor battle damage due to ground fire. Also, at least six SAMs were fired at the F-111s, all observed on the first two nights of the operation. Whether or not these AAA or SAM defenses directly caused the loss of F-111 aircraft is not known; however, two F-111s were lost due to unspecified causes during LINEBACKER II operations.[61]

(S) The first LINEBACKER II F-111 loss occurred on the first night of operations, 18 December. The second loss occurred on 22 December. In both instances, last contact was made with the aircraft while it was egressing the target area. On 23 December, the day after the second loss, contact was made with the two crewmembers who were down in an area approximately 53 NM west of Hanoi. Contact with the aircraft commander ceased on 24 December. An attempt to pick up the Weapons System Officer (WSO) on 27 December was unsuccessful due to heavy ground fire. The following day, survival supplies were dropped and the WSO was told to

move west to a less hostile area. Last radio contact was made with him on 29 December.[62] (Both crewmembers were among the prisoners of war returned from NVN following the Vietnam ceasefire.)

H. (S)(U) Pre-Ceasefire

(S) With the termination of LINEBACKER II on 29 December, F-111 strikes again shifted to Route Package I and Laos, where on 3 January 1973 they were first fragged to serve as PATHFINDER for A-7 strikes in BARREL ROLL. During the first two weeks of January, F-111s flew 126 sorties in southern NVN. Then, on 15 January 1973, all U.S. offensive operations and tactical reconnaissance over NVN ceased. For the remainder of the month all F-111 combat sorties were flown in Laos. By the end of January that month's total of F-111 sorties flown in Laos stood at 698.[63]

CHAPTER IV

ANALYSIS OF LOSSES

(S) Within six hours after the arrival of the first CONSTANT GUARD V F-111 at Takhli, four of these aircraft were launched to strike targets in Route Package V in North Vietnam. One of these, Ranger 23, failed to return. A little over two weeks later another F-111, Coach 33, disappeared on a mission over Route Package VI. On 7 November Whaler 57 did not return from a strike against a Route Package I target. Finally, following the 20 November loss of Burger 54, night TFR strikes were temporarily suspended.[64]

(S) These F-111 losses were very similar to two of the three losses experienced during COMBAT LANCER* in 1968 in that (1) little information was available regarding the causes, and (2) all but one of the losses appeared to be of such a catastrophic nature that a distress call and capsule ejection were precluded.[65] The unexplained nature of the losses troubled General John D. Ryan, Chief of Staff of the Air Force. Consequently, he initiated several investigative efforts: first, he directed the formation of an investigation team to conduct a comprehensive inquiry and review of all F-111 losses of undetermined causes (this endeavor was nicknamed CONSTANT SWEEP); simultaneously, he ordered operational testing and evaluation of the F-111 at the Tactical Air Warfare Center, Eglin AFB, to identify possible anomalies, malfunctions, or systems degradation in

*(S) COMBAT LANCER--F-111 combat operational testing in SEA, March to November 1968.

the Terrain Following Radar that could cause or contribute to losses; finally, he initiated a test of F-111 munitions delivery safety and effectiveness.[66]

(S) With the advent of LINEBACKER II operations in December, the F-111s resumed night TFR missions against military targets in the Hanoi area. Within four days of each other, on 18 and 22 December, respectively, Snug 40 and Jackel 33 were lost. The aircrew of Jackel 33 successfully ejected after reporting an engine out. This brought the aircraft loss total to six for three months of operations.[67]

A. (S)(U) Possible Contributing Factors

(U) The F-111 combat losses were all unexplained,* and most of them were considered to have been catastrophic, i.e., the time interval between the onset of the failure or hazard and the crash was so short that a distress call was impossible and the crew capsule could not be successfully ejected. The nature of a catastrophic loss strongly suggested that it occurred during low altitude flight; therefore, it was presumed by the CONSTANT SWEEP team that the F-111 catastrophic losses occurred during the very demanding night TFR portion of the combat mission which was flown at 1,000 feet AGL or lower, over both mountainous and level terrain.[68] While 30,000 hours of training at low altitudes had resulted in only one loss, 6,000 hours of combat missions in SEA had produced eight such losses.[69]

(S) A number of factors could have accounted for this increase in losses. The terrain, weather, and concentration of targets in Southeast

*The crew of Jackel 33 survived and were eventually returned to the U.S. where they explained the loss of their aircraft (see p. 54); however, at the time of the CONSTANT SWEEP investigation the cause of Jackel 33's disappearance was still unknown.

Asia, for example, created unique operational problems for F-111 strikes employing night TFR tactics. These environmental factors were new to the aircrews and added substantially to problems that had to be solved during pre-mission planning and in tactics.

(S) The major portion of a combat flight from Thailand into North Vietnam was conducted over precipitous mountains throughout Laos and North Vietnam, which were far more rugged than those found in the CONUS. Ingress routes to targets in Route Packages V and VI required overflight of 250 NM of mountainous terrain, while ingress to Route Package I required overflight of 100 NM of mountainous terrain. This meant that if terrain following techniques were used for ingress, they were employed under very hazardous conditions, with the aircraft in a continuous series of climbs and dives. Moreover, as the aircraft crossed the high ridge lines west of the Red River in Route Package V or the Laotian border in Route Package I--and thus presented itself to enemy radars--the element of surprise might have been lost. The target areas themselves were normally in the Hanoi Delta area or flat coastal area of Route Package I, thus giving the enemy a long "look time" for reaction with defensive weapons.[70] A thin overcast with a full moon behind it also created a "window shade" effect, highlighting the aircraft.

(S) F-111 missions in Southeast Asia frequently encountered heavy rain showers enroute (during the Southwest Monsoon season), or in the target area (during the Northeast Monsoon season). Rain showers built up along the high mountain ridges, increasing the hazard of TF operations during the penetration to the target. Moreover, these rain showers were much denser than those that the crews had experienced in the United States.[71]

(S) The small size of the area in which lucrative targets were located in North Vietnam permitted the enemy to anticipate where F-111 operations were to be conducted on any given night. The majority of northern targets were in the Hanoi area. Route Package I targets were constricted into the narrow coastal plain. These small target areas enabled the enemy to concentrate and integrate his air defenses. Additionally, the element of surprise sought from terrain following operations could easily have been lost because of the limited availability of suitable ingress and egress routes.

(S) These factors combined to make the Southeast Asia environment one of the most difficult in the world for the employment of a night, terrain following radar attack system such as that of the F-111. Moreover, this environment greatly reduced the margin for error and could have rendered crew or weapon system weaknesses fatal.

(C) The accident and incident history of the F-111 since 1968 had been such that the possibility of flight control or primary structure being the cause of any of the combat losses was considered very remote. Similarly, the simultaneous loss of power in both enginges was deemed highly unlikely because engine failure due to heavy rain had not been a problem at low altitudes before. Bird strikes were also discounted as probable cause of catastrophic loss since the aircrews should have been able to eject even if the wind shield had been broken on one side of the cockpit.

(C) From the absence of bomb fragment damage on returning aircraft, it was clear that the possibility of the aircraft having been knocked down by

the detonation of its own weapons was extremely remote. Since the fragment damage radius is much greater than the lethal radius, the probability of fragment damage during weapon delivery was much higher than the probability of catastrophic loss. Since there were no reported cases of bomb fragment damage to F-111s, the probability of losing aircraft to the same hazard was actually quite small.[72]

(C) The loss of radar returns (E scope blanking) on the TFR and attack radar scope was caused primarily by external attenuation of the radar signal due to weather factors. During periods of scope blanking, TF climb/dive commands to the aircraft were derived solely from the low altitude radar altimeter (LARA) inputs and no forward terrain clearance was provided for flight in rugged terrain. The phenomenon of E scope blanking due to rain was not fully recognized prior to the CONSTANT GUARD V deployment and may well have contributed to several of the losses. The loss of forward video returns was similar to that caused by radar shadowing when approaching and ascending a mountain; furthermore, rain showers of the type which caused scope blanking were generally found in the vicinity of mountain peaks. Hence, an aircrew could have misinterpreted the event and continued terrain following rather than climbing immediately to MEA. The aircraft flight path would then have been controlled by the LARA and at least two crash factors could have resulted. First, since the LARA looked downward rather than forward, the aircraft could have impacted on a steep slope. In this case, there would have been no mechanical or system failure, but only an aircrew error in failing to recognize or take precautions

following E scope blanking due to rain. Second, a dive command caused by a failure of the LARA or TFR computer could have put the aircraft in a trajectory which would have been fatal unless the aircrew detected the failure and responded within a few seconds of its occurrence. Even the fly-up safety feature (which would cause a two-G fly-up if the aircraft descended below 68 percent of the preset altitude AGL [set clearance plane]), might not have prevented a crash if the terrain were very rugged and terrain clearance was being measured by the downward-looking LARA. Either of these hypotheses associated with E scope blanking due to rain could have been applied to the loss of Ranger 23 on the first night of CONSTANT GUARD V operations. The crash of Whaler 57, presumably in weather and mountainous terrain, may also have been a result of these phenomena.[73]

(C) In the F-111's history, there were 37 reported incidents of low altitude penetration below the set clearance plane (SCP) when operating on LARA override over water or dry lake beds. In 20 of these incidents, penetration of the SCP was accompanied by failure of the 68 percent fly-up safety feature. The cause of these failures was not known. It was noteworthy that both Burger 54 and presumably Snug 40 crashed during low altitude egress over the Gulf of Tonkin. Both of these aircraft had histories of LARA discrepancy writeups which were definitely on the high side of the distribution for the fleet of F-111 aircraft assigned to the 474th TFW at Takhli. However, a relationship between this fact and the tragedies was not firmly established.[74]

(C) The time available to the aircrew to detect and react to a LARA/TFR system failure could have been only a few seconds when flying at 500 feet or less. A particularly hazardous situation would have resulted if a failure producing a dive without the 68 percent fly-up protection occurred during an automatic letdown. Figure 4 indicates the reaction time as a function of altitude during such a dive from 500 feet AGL.[75] Of importance is the fact that during the CONSTANT GUARD V missions, egressing crews tended to fly low because they felt there was more safety at low levels. In view of the identified enemy threat, this was true; however, from the viewpoint of systems failure, the opposite might have been true.[76]

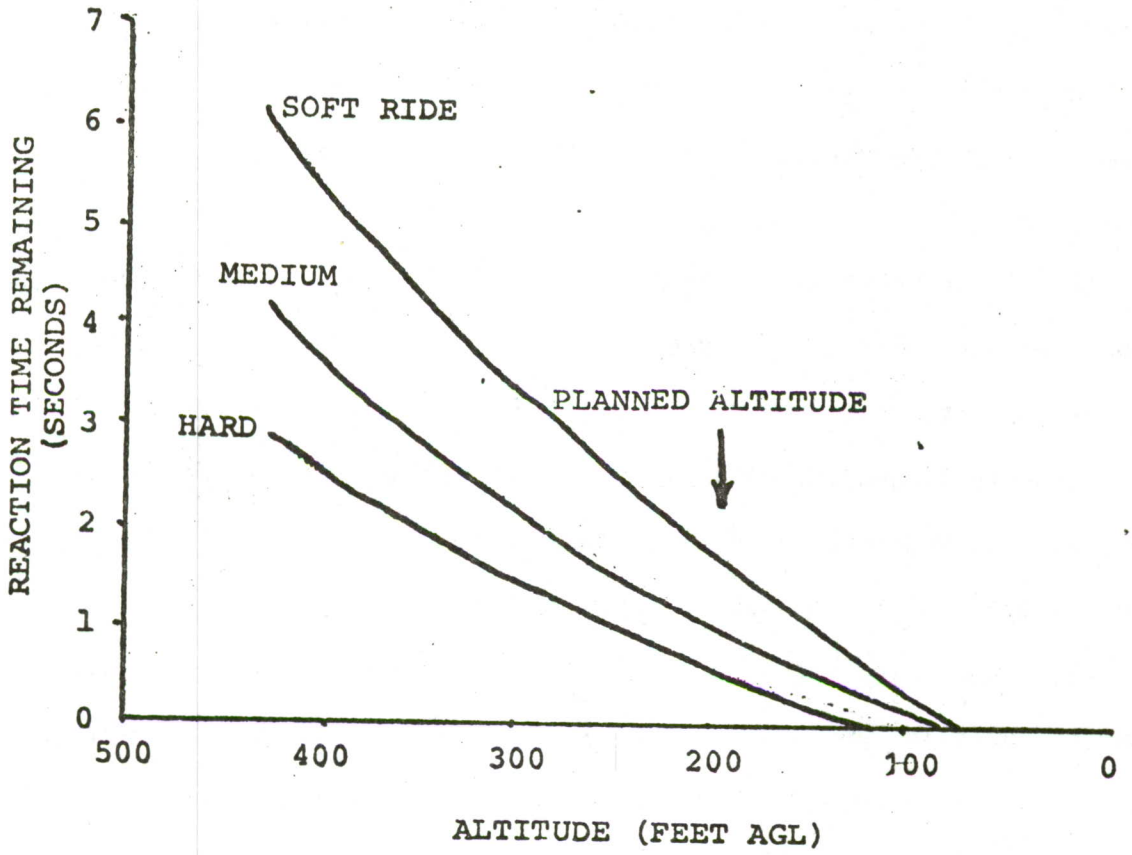
(S) In December, as a direct result of the CONSTANT SWEEP team findings regarding TFR/LARA failures, the Chief of Staff advised all F-111 units of the low-level hazard and suggested egress altitudes of 500 feet AGL or higher to lessen the possibility of losses to TFR/LARA system failures. Moreover, he suggested immediate climb to MEA if it appeared possible that the E scope would blank due to weather.[77]

(S) Enemy air defense was always a possible cause of the losses; however, only in the case of Coach 33 did Hanoi make an F-111 shootdown claim prior to a loss announcement by the U.S. Command. Coach 33's target was in a heavily defended area, and enemy defensive reactions had been intense on the preceding night. However, through the month of November, F-111 aircrews reported no AAA or small-arms damage, and damage from approximately 22 SAM firings was sustained only once. Another hypothesis (mentioned in 28 percent of the aircrew responses to a questionnaire used by the investigating team) was that distraction and disorientation

FIGURE 4

REACTION TIME REMAINING IF SYSTEM FAILURE OCCURS DURING LETDOWN

PLANNED TFR LETDOWN FROM 500' TO 200' AGL
DIVE COMMAND WITHOUT 68% FLY UP
NET +4g RECOVERY PULL UP
RESULTS FROM GENERAL DYNAMICS FLIGHT SIMULATOR
480 KTAS



(THIS PAGE IS UNCLASSIFIED)

while performing evasive or weapon delivery maneuvers (stabilized climb) caused the aircrew of Coach 33 to fly into the ground. The location of the crash site relative to the planned run-in track to the target indicated that the aircraft may have crashed prior to weapon delivery.[78]

B. (S)(U) Losses

(S) Examination of the loss data revealed several possible causes in each instance. Ranger 23 disappeared while on a strike mission against the Yen Son Military Storage Facility located southeast of Yen Bai in Route Package V. The flight plan for Ranger 23 included a lengthy portion of TFR flight over extremely rugged karst* areas. This terrain included abrupt variations up to 4,000 feet in passing from mountain peaks to valley floors. There were several 9,000-foot peaks in the vicinity of the flight path which towered over the typical 5,000 to 6,000-foot peaks in the region. Approximately 4 NM short of the target on the inbound track was a hill rising about 200 feet above the surrounding terrain. The target was adjacent to the Red River and lay in a relatively flat region, but beginning about 2 to 3 NM beyond the target along the extended inbound track the terrain rose in a series of 300- to 400-foot hills.

(S) Enroute weather for Ranger 23 was reported as scattered clouds at 4,000 feet with a second layer of scattered clouds at 12,000 feet; visibility was seven miles. Other F-111 aircraft encountered numerous heavy thunderstorms in the area.

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*A limestone region characterized by abrupt ridges, irregular (sometimes towering) rock formations, depressions, caverns, and underground streams.

(S) The last radio contact with Ranger 23 was at 2141, and the last radar contact occurred at 2145 as the aircraft approached the Laotian border. At that time the pilot was deviating from his programmed track to avoid thunderstorms. His last reported altitude was 15,000 feet. U.S. ground-based radar coverage at 15,000 feet extended approximately 70 NM beyond the last reflected position. Taking the flight deviation into account, the estimated descent point would have been just north of Barthelemy Pass.

(S) On 29 September, after Ranger 23's loss had been officially announced, Radio Hanoi reported a shootdown of an F-111 in Yen Bai Province. No elaborate narrative or photography was produced to substantiate this claim. Moreover, all F-111 missions on the night of 28 September were fragged against targets in Yen Bai Province.[79]

(S) Coach 33 disappeared on 16 October while on a strike against the Dai Loi Railroad Bridge located about 6.1 NM east-southeast of Vinh Yen on the Northwest rail line. The flight was planned for 15,500 feet to the descent point where a 1,000-foot MEA was to have been flown until approaching Thud Ridge,* then a descent to 500-foot TFR was planned, followed by bomb release and egress.

(S) The MEA portions of the flight ranged over 6,000 to 9,000-foot peaks inbound and 4,000-foot peaks outboard. The TFR portions were over terrain with variations of 1,000 feet. The final leg into the target paralleled Thud Ridge to the west. The terrain dropped about 600 feet during this run in. Directly on the planned track and about 7.4 NM from the target

*A mountain range in RP VI in NVN.



Base 54714 8-66

Figure 5

was a hill rising some 360 feet above its surroundings. Terrain beyond the target was the relatively flat Red River Plain.

(S) Weather enroute and for the target area was reported to include isolated thundershowers and rain showers. Target area weather was reported to be 1,000 to 1,500 feet broken with 10 NM visibility under the ceiling. Thunderstorms and lightning were observed by F-111 crews in the area.

(S) Coach 33's flight plan took it into the heart of the SAM envelope for Route Packages V and VI A, and it came within range of at least five photo-confirmed, occupied SAM sites. An estimated 12 SAM battalions operated in the Route Packages V and VI A area between Yen Bai and Hanoi. There were at least ten 57mm and two 85mm guns located along the route to the target area portion of Coach 33's track.* Numerous light AAA guns (12.7mm and 14.5mm) and automatic weapons were also scattered along the track. In addition, photographs taken in July west of Phui Yen (near Coach 33's track) showed two mobile gun systems capable of tracking and firing at an aircraft flying at 500 feet.

(U) The last known location of Coach 33 was in Laos about 50 NM from the North Vietnamese border, five minutes before its descent scheduled for 2339. At that point, U.S. radar lost contact. At 0007, while in the vicinity of Coach 33's fragged target, Coach 27 heard some seemingly-normal conversation between Coach 33 and another agency.

(U) North Vietnamese press releases reported an F-111 was shot down by AAA fire in Vinh Phuc Province, northwest of Hanoi and along Coach 33's projected

*(S) During low level flight these guns presented no threat to the F-111. However, should a TFR failure have occurred and the aircraft been forced to a higher altitude, the potential for a threat existed.

flight path into the target area. On 18 October, two photographs purporting to show the wreckage of an F-111 shot down in Vinh Phuc Province were released by Hanoi. On 19 and 20 October Radio Hanoi broadcast details of crew identification papers and claimed Coach 33 to be the 4,000th U.S. plane shot down. Subsequently, the U.S. investigating team also received Japanese news film showing the crash site. Analysis of the film confirmed that the wreckage shown was from an F-111.[80]

(S) Whaler 57 disappeared on 7 November 1972 while on a mission against the Luat Son Highway Ferry and Ford Complex located on Route 101B about 6.5NM southeast of Bat Lake in Route Package I.

(S) An altitude of 15,500 feet was planned for ingress to a descent point. A 70 NM MEA track was to be flown from descent point to within approximately 10 NM of the target. At this time the crew was to have used TFR at 500 feet to the target, returning at 1,000 feet TFR from target to a scheduled climbout point. They were to have returned to base at 24,500 feet.

(U) The terrain from the descent point to 10 miles from the target was irregular with mountains and karst formations along the track. The MEA for this leg was 3,455 feet. Ten miles from the target, where flight planning called for TFR at 500 feet, terrain features were karst formation for the first two-thirds of the leg, with the last third being level. About 3 NM enroute to the target was a series of 600-foot hills. Beyond the target the terrain was tidal plain with few significant features. The return flight plan took the aircraft over similar terrain.

(S) Weather conditions reported along Whaler 57's planned flight path consisted of scattered clouds between 2,500 and 10,000 feet in the

western section of Southern Laos, with broken cloudy conditions between 2,500 and 10,000 feet along the Laotian-North Vietnamese border. Visibility throughout Southern Laos was 7 NM. Over the target area, the weather deteriorated, with visibility below 5 NM in rain. Cloud cover was reported one to two thousand feet and broken, variable overcast with a second broken cloud layer at 10,000 feet. Thunderstorms were reported in the target area. Three other F-111s were scheduled into lower Route Package I, but aborted due to severe weather conditions.

(S) Enroute to the target, Whaler 57 could have encountered isolated AAA units. At approximately 35 NM from the target, its track took it over a heavy AAA concentration estimated to have had one 85mm, five 57mm, and twenty-two 23mm AAA guns.

(S) Whaler 57 took off from Takhli at 0219, 7 November. At 0250, he checked in with ABCCC, but no position report was given at that time. Two unexplained incidents involving Mode 3 IFF squawks* were noted. The first squawk intercepted by U.S. radar was at 0257 and would have placed Whaler 57 approximately 45 NM south of track. The second intercept, at 0408, one hour and two minutes after the last radio contact, was a Mode 3 MAYDAY squawk. Investigations of these IFF squawk incidents were not conclusive in tying these transmission to Whaler 57.

(U) The initial North Vietnamese report of an F-111 shootdown was made the day after the U.S. announced the loss of Whaler 57. Significantly,

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*An encoded signal transmitted from an aircraft which, when received at a ground station, provides identification and location of the aircraft on a radar screen.

this was the first Hanoi report to credit a Western news agency as the source of the report.[81]

(S) The fourth F-111 to be lost, Burger 54, disappeared on 20 November 1972 while on a strike mission against the Co Giang Transshipment Point located on Route 101 about 8.5 NM southwest of Quang Khe in Route Package I.

(S) The planned flight profile included a descent from 15,500 feet to a tactical MEA prior to reaching the North Vietnamese border. A 1,000-foot AGL TFR flight from the initial point to 10 NM short of the target was to be followed by a 300-foot AGL run in to the target and a 200-foot altitude egress out over the Gulf of Tonkin. The return to Takhli was to be accomplished at high altitude south of the Demilitarized Zone. According to the flight plan, Burger 54 was to have crossed terrain containing some 4,500-foot peaks located just prior to the karst region with 2,000-foot peaks.

(S) Enroute to the target, there was a cloud deck from 2,000 to 8,000 feet with no rain or thunderstorms reported along the flight route. Over the target, visibility was reduced to between two and four nautical miles with both thundershowers and rainshowers prevalent. A 1,000-foot cloud deck was topped with a 20,000-foot overcast.

(U) At 0239, Burger 54 reached the low-level entry point. From there he descended from 15,500 feet to 3,000 feet at the initial point. The initial point was reached at 0245, the time of the last radar and radio contact with Burger 54. According to 7AF, at this last contact there were no indications of any problems.

(S) Although there was no evidence of enemy air defense reaction, another F-111, Burger 52, reported signals from three enemy height-finder radars one hour prior to Burger 54's time on target. The enemy did not announce any shoot-down which could have possibly been Burger 54.

(U) A fairly good indication of Burger 54's fate was revealed several days later when pieces of wreckage of the aircraft were found on the coast approximately 14 miles north of DaNang (all parts found floating were honeycomb). Prevailing currents flowing along the coast at about one-half to one knot suggested that the wreckage could have traveled between 120 and 240 NM during the period following the loss. Although it was not possible to determine the exact location of impact, the crash site could have been within the area of the planned egress. Analysis of the debris indicated post-impact fire, 72° wing set at impact, and that the crew module probably had not separated at the time of impact.[82]

(S) Snug 40 disappeared on 18 December while on a night TFR strike mission against the Hanoi International Radcom Transmitter, located 5.3 NM west-southwest of Hanoi. The flight profile called for an altitude of 19,500 feet followed by a TFR letdown over a region of 3,000-foot peaks. Shortly after letdown, the track descended to 500 feet into the target area in the Red River Plain, which was generally void of elevation features. The TFR flight at 500 feet continued past the target and was 130 NM long overall, the last 20 NM of which were over the Gulf of Tonkin.

(S) The weather enroute to and at the target area was reported to be 4,000 to 6,000 feet, scattered to broken clouds. No rain or thunderstorms

were reported, and visibility was six to ten miles with 91 percent moon illumination.

(S) At 2030, U.S. radar at Udorn had its last contact with Snug 40. By 2037, the aircraft was to begin its descent from 19,500 feet. An MEA profile was to continue to the initial point where TFR at 500 feet AGL was to begin. At 2054, one minute after scheduled time over target, Snug 40 transmitted an off-target call. Another call from Snug 40 was received at 2100 on UHF but there was no radar contact. Further attempts at radio contact were unsuccessful. There was no indication of any problem. The loss of Snug 40 and the earlier loss of Burger 54 were similar in that both had an egress plan of TFR over water.[83]

(S) The final F-111 to be lost, Jackel 33, disappeared on 22 December 1972 while on a strike mission against the Hanoi Port Facility located near highway Route 117A and water Route 27E, 1.6 NM southeast of the center of Hanoi.

(S) Unlike the previous F-111 losses during the three-month period, the crew of Jackel 33 was able to eject from their aircraft and have since returned to the U.S. According to the weapons system officer, AAA was always behind them and no problem. However, Jackel 33 did encounter small arms fire, one round of which ruptured the aircraft's hydraulic system forcing the pilot to shut down his right engine and ultimately eject due to loss of flight controls.[84]

C. (S)(U) Conclusion

(S) It was not possible to establish with certainty the specific cause for any but the last of the F-111 combat losses, although there

was sufficient evidence to indicate a probable cause for each. It was concluded that no one cause was responsible for all six losses. Two of the aircraft (Ranger 23 and Whaler 57) apparently crashed in the mountains while attempting to penetrate an area of rain storms that degraded the aircraft's radar and disoriented the aircrews. One of the aircraft (Coach 33) crashed in the vicinity of the target, having been shot down or having flown into the ground during a maneuver to evade enemy defenses. The other two aircraft (Burger 54 and Snug 40) most likely crashed in the Gulf of Tonkin due to a limitation or failure of the LARA system. As noted, Jackel 33 was shot down.

(S) The most useful results of the CONSTANT SWEEP investigation were the findings that led to corrective actions to overcome problems related to aircrew training, tactics, weaponry, and LARA/TFR system failures.

(S) It should be noted that the F-111 combat loss rate was remarkably similar to that of the Navy A-6 and the F-105F (in limited COMMANDO NAIL sorties) when performing night, terrain following missions. Since four of the six F-111 losses probably occurred during ingress or egress from the target, it was logical to conclude that improved procedures and increased LARA/TFR reliability would reduce the loss rate. Bank limitations in the F-111A TFR system were highlighted by the TAC OT&E* project (TAC PROJECT 72A-182U). A Combat ROC for improved TFR capability was submitted through PACAF and validated by the Air Staff. Incorporation of the capability will allow positive corrections to aircraft track in the final portions of an attack and during defensive maneuvering. 85

*OT&E--operational test and evaluation.

CHAPTER V

EVALUATION OF EFFECTIVENESS

A. (S)(U) Summary of Operations

(S) The first F-111 strikes were scheduled on 28 September 1972, the same day the aircraft arrived in SEA. The targets were carefully selected to avoid high threat areas and yet still provide an estimate of the system's combat capability. The unexplained loss of one of the aircraft on the first mission brought a halt to combat operations and led to an intense investigation of aircraft systems and employment tactics. The next five days were devoted to further training and orientation flights for the pilots and to the revision of penetration and enroute altitude criteria.[86]

(S) Beginning 4 October 1972 the F-111s were again fragged for combat operations, but the target selection was even more cautious than before. Training and orientation flights, both day and night, continued through 12 October. By that time sufficient confidence had been gained in the aircraft and tactics to permit the scheduling of 24 sorties into RPs V and VI A on the night of 13 October. Three of the 24 sorties were sent against targets in the high-threat areas. Two days later, nine of the sorties were against high-threat targets.[87] A second F-111 was lost on 16 October, leading to a further reappraisal of tactics. Also, to permit monitoring of F-111 missions, each crew was to provide position reports on HF radio at each turn point along the flight route so long as the aircraft was beyond radar control.

(S) Through 22 October, a total of 317 sorties had been fragged into RPs V and VI A. Of these, 280 were actually flown and 215 expended

against their targets.[88] On 23 October bombing was halted north of the 20th Parallel in NVN, and efforts were intensified to identify targets elsewhere in SEA. Initially, these targets were concentrated primarily in RP I, but crews were provided alternate targets in the STEEL TIGER and BARREL ROLL areas of Laos by ABCCC-directed releases using tactical air navigation (TACAN) bearing/Distance Measuring Equipment (DME) position.[89]

(S) To increase bombing effectiveness against targets of such low radar-reflectivity* as truck parks and interdiction points, low-threat targets were selected to permit the F-111 to fly at higher altitudes (15,000 to 18,000 feet) and carry a full load of 24 MK-82 bombs.[90]

(S) Beginning 29 October 1972, six sorties per day were fragged into the BARREL ROLL area. The adaptation of the F-111 to an offset bombing role, in conjunction with the AN/PPN-18 Forward Air Control Transponder, precipitated a sharp increase in the number of sorties being fragged into Laos. By the end of November the average number had reached 33 per day, and continued at that rate through the ceasefire in Laos. During this period, 90 percent of the strikes in Laos used the beacon offset system.[91]

(S) Strikes continued in RP I throughout November and December, but it was not until the advent of LINEBACKER II and the attendant resumption of bombing north of the 20th Parallel that the opportunity was again provided to test the system and its employment concept in the high-threat

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*(S) The basic F-111A has a capability for setting only one offset aim point in the weapons delivery system. This immediately showed up as a limitation in their operations against targets of poor radar reflectivity. Multiple offset aim point capability allows cross referencing to ensure proper target acquisition and lineup. The rapid recognition of this shortcoming led to the accelerated incorporation of an already approved multiple offset aim point (MOAP) capability in the SEA F-111A aircraft.

areas. During that operation a total of 154 F-111 sorties, all at night, were flown against a variety of NVN targets, including airfields, SAM sites, radio communications facilities, and LOCs.[92]

(S) Following the termination of LINEBACKER II operations on 29 December, F-111 sorties were again directed against targets in RP I and Laos, including sorties that were fragged to serve as PATHFINDER for A-7/F-4 strikes in Laos.[93]

B. (S)(U) Operational Factors

(S) The initial employment concept for the F-111 called for low-level penetrations and provided ordnance delivery tactics for both low-drag and high-drag weapons. The fragmentation patterns of the 2,000 pound MK-84 low-drag bomb dictated higher delivery altitudes. The tactic devised was a 10 degree stabilized climb to approximately 1,400 feet, initiated 15 to 20 seconds prior to ordnance release. Following the loss of two aircraft, TFR minimums were raised from 200 to 500 feet, and weapon delivery was restricted to the 500 pound MK-82 high-drag (SNAKE-EYE) bombs in the level mode. TFR flight at 200 feet was still permitted to avoid defenses when SAM and AAA tracking was indicated on the RHAW equipment. Later, when it was discovered that SAM acquisition and guidance radar was effectively tracking aircraft at 500-foot altitudes, penetrations at 200 feet were again authorized.[94]

(S) Initial target selections were made from a 7AF high-value target list based on CINCPAC strike priorities. Of the 189 targets chosen, 144 were considered suitable for F-111 operations. In evaluating the target

selection list, 7AF suggested that bridges be assigned a lower priority, and recommended the addition of 56 area targets. The targets from the revised list were photographed and SENTINEL LOCK coordinates produced. The unit developed target folders, selected aim points, and prepared hand drawn radar predictions based on optimum attack headings.[95]

(S) During the course of F-111 operations before the bombing halt of 23 October, continuing target selections were made on the basis of their value as reflected in the CINCPAC list of priorities. However, the more lucrative targets were generally excluded from consideration because they were located in restricted areas.[96] Bridges, which at one time had been very high on the priority list, had to be excluded from consideration because the use of MK-82s against bridges had proven ineffective. In RPs V and VI A, railroad sidings, spurs, and other LOC now became priority targets.[97] There were other considerations, such as the necessity to avoid collateral damage and civilian casualties, which further limited the number of radar-significant targets available for strike.[98]

(S) A continuing problem throughout F-111 operations was the inadequacy of the charts used in making radar predictions. It was found that they were somewhat inaccurate in portraying terrain features, and the hand drawn predictions upon which target crosshair placement was originally predicated did not always coincide with the radar scope presentation. Greater emphasis was placed on collecting, analyzing, and cataloging radar scope photography to reduce the reliance on predictions.[99]

(U) Performance of the ES-85 Mobile Film Processing Facility was commendable; average production was 50 radar predictions and 3,000 feet of 35mm radar scope film per day.[100]

(S) Relatively inexperienced weapons system officers (WSOs) had difficulty adjusting to the extremely brief spans of time available for them to look at their radar aim points. Many crews had only a matter of seconds to acquire their targets or aim points while at TFR altitudes. This, in addition to the problems normally associated with initial combat sorties, resulted in instances of incorrect crosshair placement or bombing in less then optimum modes.[101] Yet, because of the TDY nature of the deployment, a new group of inexperienced crews was scheduled to enter training in early 1973.[102]

C. (S)(U) Destruction, Harassment, Presence

(S) It was recognized that the F-111 concept of employment, i.e., single-ship penetration at a low level, was not likely to produce spectacular results in terms of physical damage alone with conventional weapons. Its value was based on a combination of three factors: destruction, harassment, and presence. The F-111 provided the Air Force with the capability to strike the enemy, day and night and in poor weather. Although the number of F-111 strike sorties was modest (13 sorties per day), the unique capability of the F-111 to penetrate enemy defenses and strike targets around-the-clock added a formidable psychological/harassment effect to the purely military damage resulting from the strikes. The F-111 had the capability to appear suddenly, and virtually without warning. This ever-present threat was, in itself, of significant importance.[103]

(S) In attacking airfields, for instance, a single aircraft could not normally be expected to shut down flight operations for any significant length of time, but the F-111 strikes during the nighttime hours contributed an immeasurable psychological effect by harassing defenses and overnight repair efforts.[104] Even though the F-111 sorties generally caused only light damage to airfields, it is interesting to note that the only reported period of non-operational status at Yen Bai was the result of a successful F-111 attack.[105]

(S) The F-111 represented only an infinitesimal portion of the total strike resources committed against storage facilities in NVN, yet they were able to record significant damage. Again, however, the major contribution was in keeping pressure on the enemy in areas where significant damage had already been done and striking SAM sites prior to B-52 attacks.[106]

D. (S)(U) Logistics and Maintenance

(S) The 474th TFW maintenance organization, which shared maintenance facilities with the 366th TFW until the latter unit redeployed at the end of October, was fully operational within a very short time of its arrival at Takhli. Routine maintenance was accomplished on schedule, with virtually no delayed maintenance backlog.[107]

(S) Following the loss of Ranger 23, the F-111s were not allowed to fly in the high threat areas of RPs V and VI A unless all systems aboard, primary and redundant, were fully operational. This caused an abrupt rise in the number of aborts and in the NORS* rate. If a system deficiency was discovered prior to takeoff, the aircraft would not be permitted to fly; if the problem arose after takeoff, the crew was

*NORS--not operationally ready, supply.

required to abort the mission. To ensure the availability of backup aircraft to replace the aborts whenever practical, the 474th TFW maintained an average of four combat configured spares.[108]

(S) Aircraft antennas, modulators, and LARA indicators were the principal items of concern. At one time, 13 aircraft were NORS due to the LARA indicators.[109] Of 53 aborts between 28 September and 22 October 1972, 39 were due to failure of some mode of the terrain following radar, attack radar, or inertial navigation systems. The first two systems, which together accounted for 32 of the 39 aborts, were identified as major shortfall items.[110] The LARA indicators were in critically short supply. They were depot reparable items, and it was only through the closest possible monitoring of each asset in the system that the serious shortage was prevented from adversely affecting combat operations.[111]

(S) Between 23 October and 17 December the abort rate was insignificant because no strikes were being flown into the high-threat areas north of the 20th Parallel, where strikes could only be conducted if all systems were fully operational. On 18 December, the first day of LINEBACKER II operations, an F-111 again was forced to abort because of a malfunction in the TFR system, but that was the only abort resulting from such a malfunction for the remainder of combat operations over North Vietnam.*[112]

(S) The NORS rate at Takhli was approximately 11 percent, compared to an average of 4 to 5 percent at Nellis when the F-111 was undergoing testing and evaluation. Although the avionics equipment accounted for the majority of the NORS items, it was also discovered that such items

*(C) Crew experience levels may have been a factor in compensating for some equipment malfunctions, with the net result being the very low abort rate noted.

as struts and brakes were not as durable as had been expected and were contributing to the NORS problem.[113]

(S) The cannibalization rate, which had reached 33.2 percent by December,[114] was significantly higher than had been the case at Nellis for twice the number of aircraft. This was due, in part, to the inadequate supply of spare parts available at Takhli upon arrival of the 474th TFW. The high point in December reflects the all-out effort involved in LINEBACKER II. Despite the relatively high NORS and cannibalization rates, combat operations were not adversely affected.[115]

E. (S)(U) Ability to Perform in Intended Role

(S) The F-111 did not really have an opportunity to prove the full range of its combat capabilities. The initial concept of operations became suspect on the very first mission on 28 September 1972 with the unexplained loss of Ranger 23. There followed an extensive period of crew training and orientation, and reevaluation of the mission concepts and aircraft capabilities.* From 28 September 1972 through the end of LINEBACKER II operations, it was employed against NVN targets on a total of only 33 days, and only 22 days against RPs V and VI A targets. Of 434 total sorties flown in the upper route packages, 369 expended their ordnance on target.[116]

(S) Because of the cautious initial employment of the F-111, the concept of committing it only against high-priority, radar-significant targets received no practical application until the LINEBACKER II campaign. From the beginning, target suitability in terms of radar reflectivity was less important than the selection of low-threat targets. Also contributing

*Nevertheless, very few changes were made.

to this trend was the scarcity of radar-significant targets authorized for strike.[117]

(S) The scarcity of radar-significant targets was but one of the problems faced by targeteers. The desire to avoid stereotyping the missions required that approach routes and run-in headings be varied as much as possible. The nature of the terrain in NVN and the relatively confined space into which the targets were packed made it difficult to meet this requirement.[118] Of even more serious concern was the lack of a reliable combat CEP for the F-111. The initial employment against low-threat targets did not provide an adequate basis for assessment. Further, the very nature of the tactics employed--night, low-level, high-speed, radar delivery--precluded accurate damage assessment by the crew. Neither was post-strike photography very helpful: of 203 strikes flown through 22 October, post strike photography was limited to 85 by cloud cover. Of the 85, only 23 could be correlated with F-111 strikes. Using this as a basis, a CEP of 656 feet was obtained, but the limited sample size made the results suspect.[119] The target selection process had to take this lack of reliable CEP into consideration, and choose run-in headings which would minimize the possibility of collateral damage to non-military areas.

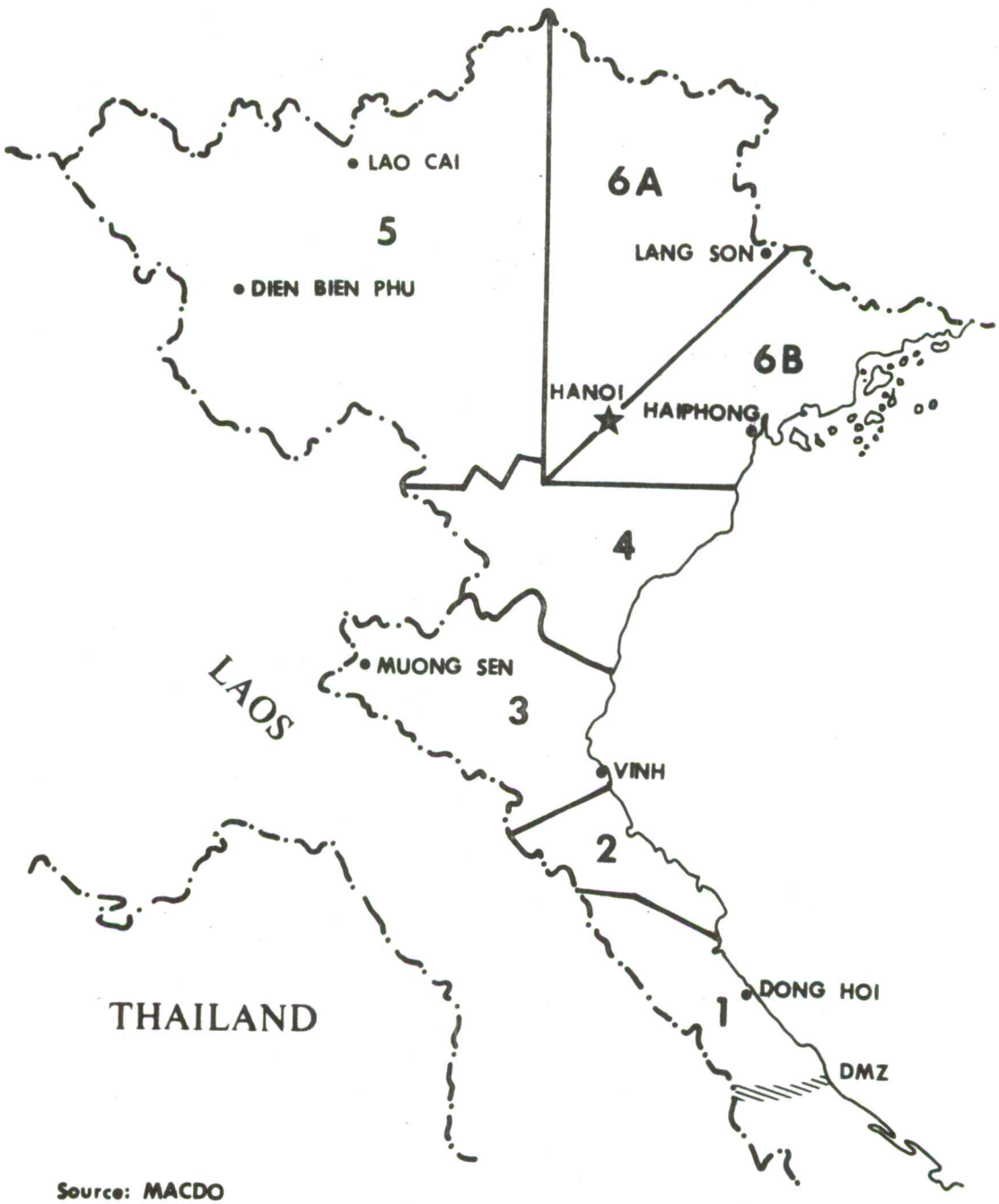
(S) Between 23 October and 18 December the F-111 did not operate in its designed role. Its activities were largely limited to bombing from medium altitudes, and there was little opportunity to take advantage of its unique design characteristics. Nonetheless, its subsequent performance during the LINEBACKER II operations demonstrated that it was

capable of doing what it was designed to do. It proved to be an effective tactical aircraft in the multiple-threat environment of NVN. During the early stages of LINEBACKER II it was targeted against airfields in an attempt to minimize the MIG threat. It was observed that there were far fewer MIG reactions than during previous LINEBACKER operations.* During the latter stages of LINEBACKER II, the F-111 force worked in concert with B-52s, striking SAM sites in advance of B-52 operations to reduce the SAM threat. Subsequently, the F-111 performed with great effectiveness in Laos using the beacon bombing technique. In these varied roles, the F-111 demonstrated its ability to penetrate the enemy defenses at low altitude and conduct strikes against targets in heavily defended areas.** [120]

*(S) While this decrease of MIG reactions might be attributable in part to the F-111 strikes, the timing of LINEBACKER II operations (most of which were conducted at night) was also a significant factor in the reduced level of MIG reactions.

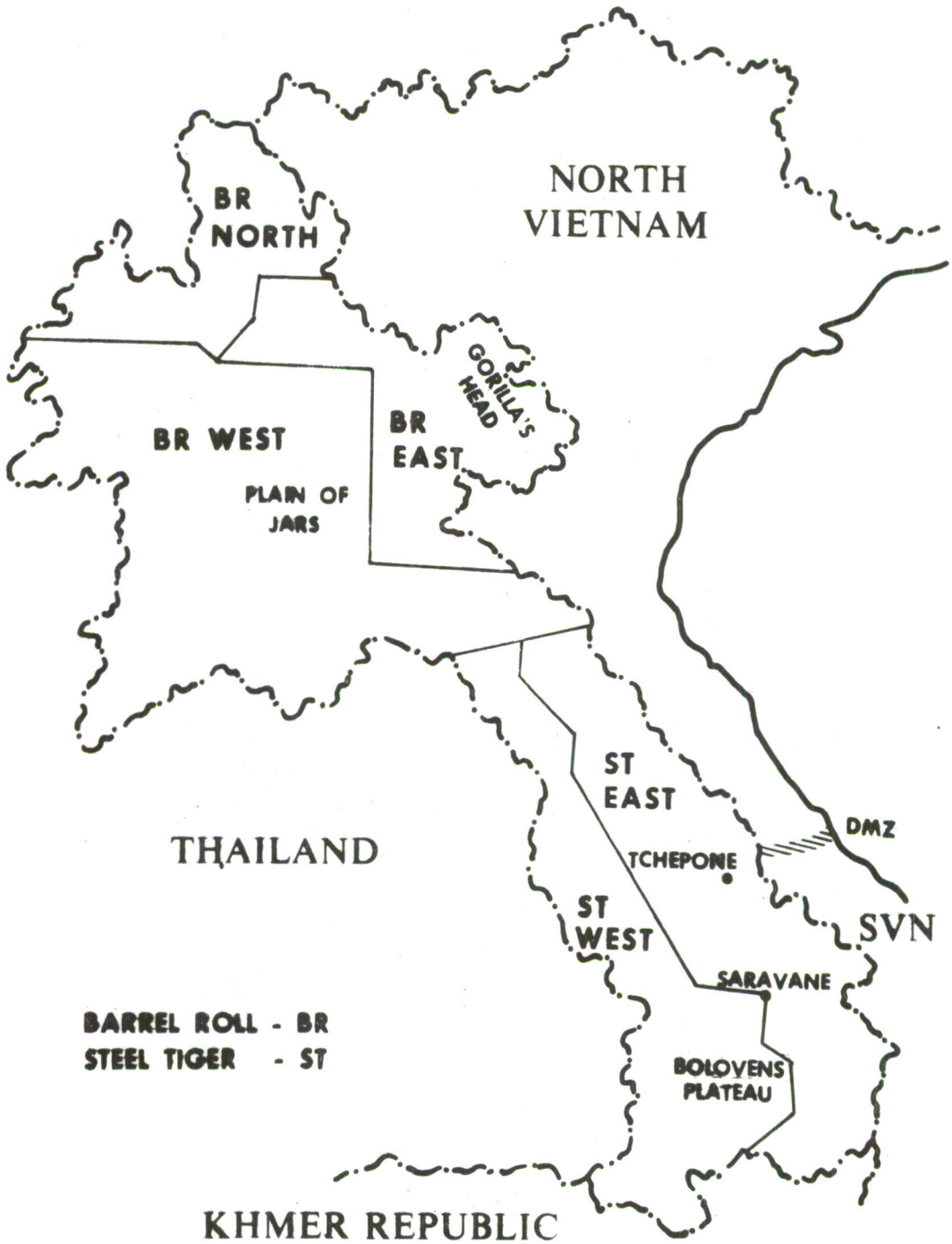
**(S) All F-111 operations in SEA, particularly LINEBACKER II, pointed up a deficiency in an effective high speed, low altitude deliverable, area coverage munitions. A Combat ROC was submitted through PACAF and validated by Air Staff to produce and certify such a munition. This development will greatly enhance the F-111 strike capability at TFR altitudes against such targets as airfields, SAM sites, etc.

NORTH VIETNAM OPERATING AREAS



Source: MACDO

LAOS OPERATING AREAS



Source: USAF CHECO

FOOTNOTES

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26. Op. Cit., Air Augmentation-Thailand, pp. II-11, II-12.

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28. Ibid., p. II-13.

29. Ibid., pp. II-13, II-14.

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30. Op. Cit., Air Augmentation-Thailand, pp. II-16, II-17.

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GLOSSARY

AAA	Anti-aircraft Artillery
ABCCC	Airborne Battlefield Command and Control Center
ACIC	Aeronautical Chart and Information Center
ADVON	Advanced Echelon
AF	Air Force
AFB	Air Force Base
AGE	Aerospace Ground Equipment
AGL	Above Ground Level
AOB	Air Order of Battle
ATTG	Automated Tactical Target Graphics
BDA	Bomb Damage Assessment
CEP	Circular Error Probable
Combat ROC	Required Operational Capabilities statement
CONUS	Continental United States
DMAAC	Defense Mapping Agency Aerospace Center
DME	Distance Measuring Equipment
ECM	Electronic Counter-Measure(s)
ETA	Estimated Time of Arrival
FAC	Forward Air Controller
FAG	Forward Air Guide
GCI	Ground-Controlled Intercept
GOT	Gulf of Tonkin
HF	High Frequency
IFR	Instrument Flight Rules
KTAS	Knots True Air Speed
LARA	Low Altitude Radar Altimeter
LOC	Lines of Communication
LORAN	Long Range Airborne Navigation
MAC	Military Airlift Command
MEA	Minimum Enroute Altitude
MOAP	Multiple Offset Aim Point

NM	Nautical Miles
NVN	North Vietnam(ese)
NORS	Not Operationally Ready, Supply
OAP	Offset Aim Point
OT&E	Operational Test and Evaluation
PACAF	Pacific Air Force(s)
PAD	Programmed Action Directive
PME	Precision Measuring Equipment
PMEL	Precision Measuring Equipment Laboratory
RHAW	Radar Homing and Warning
RITS	Reconnaissance Intelligence Technical Squadron
RP	Route Package
RTAFB	Royal Thai Air Force Base
RTG	Reconnaissance Tactical Group
SAM	Surface-to-Air Missile
SAR	Search and Rescue
SCP	Set Clearance Plane
SEA	Southeast Asia
TAC	Tactical Air Command
TAC AIR	Tactical Air
TACC	Tactical Air Control Center
TACAN	Tactical Air Navigation
TCTO	Time Compliance Technical Order
TF	Terrain Following
TFCU	Transportable Field Calibration Unit
TFR	Terrain Following Radar
TFS	Tactical Fighter Squadron
TFW	Tactical Fighter Wing
TOT	Time Over Target
WSO	Weapons System Officer